RADIO

AN BIES IN

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IS THERE A FOURTH DIMENSION?

RADIO AND HOBBIES IN AUSTRALIA

THE WAR AND SERVICING

IT is gratifying to note that the authorities are apparently well aware of the necessity of keeping Australia's broadcasting receivers in operation under wartime conditions. Valves have been made available and raw materials have been released at more or less regular intervals for the manufacture of indispensable replacement components.

The releases have certainly been limited both in scope and in quantity, but to date sufficient materials have been available to keep the majority of broadcast receivers in operation.

However, the fact must be borne in mind that there has been a heavy and consistent drain on old stocks. As these stocks become depleted and as existing receivers age, there will be a gradually increasing demand for replacement components. Any further reduction in the amount of material released for this purpose will inevitably mean that many receivers will go out of commission for the duration.

Then there is the matter of radio servicing personnel. Recently the Department of War Organisation of Industry conducted, through various trade channels, a complete survey of service establishments, service personnel and service equipment in Sydney and suburbs. As we go to press they are well on the way with a similar survey covering the rest of New South Wales.

A great many servicemen have enlisted or have been called up since the outbreak of hostilities, and those left behind are finding it very difficult to cope with all the work. The idea of the State-wide survey is to preserve a skeleton network of radio servicemen, so that each particular district will be catered for.

It is quite likely that many readers of "Radio and Hobbies" are doing service work in their spare time, small as it probably is under the present circumstances. Their names would probably not appear on any trade list.

In normal times, part-time servicing—as distinct from the hobby angle—is not altogether to be encouraged, because it seriously cuts into the livelihood of full-time servicemen. Now, however, it is a case of all helping who can possibly do so. The Department of War Organisation of Industry is not unwilling to register part-time servicemen where the amount of work does not warrant a man full time.

Those who are doing service work part-time and who have not already registered with the Department of War Organisation of Industry would be well advised to look into the matter of registering themselves and their equipment immediately.

It is necessary to fill in and sign a questionnaire form giving such details as to the district in which you live, and of other known servicemen or service organisations operating in the same district. There are questions as to other occupations and as regards experience and the period of time over which you have been engaged in this way. It is also necessary to give details of the test equipment available.

At the moment, the full details of the scheme have not been finalised, but it is reasonable to assume that the personnel finally selected to comprise the skeleton network will be given a measure of protection against military or other call-ups, and, most probably, a priority in regard to the supply of components.

This latter statement should not be treated as the signal for all and sundry to write in to the department concerned. If you are at present doing service work or are really capable and able to do such work, then you should immediately look into the matter for yourself.

If radio is just your hobby and your time is fully occupied do not embarrass the department by writing pointless letters. Those selected after application will have definite responsibilities and a definite job of work to do.

The matter, at present, concerns readers in the State of New South Wales. It is reasonable to assume that the same principles will be carried into effect in other States.

W. N. Williams

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ALLIED SOLDIERS ARE FIGHTING A WAR

Allied troops, fresh from farms, workshops and offices, are finding themselves in many strange places. Here, three US soldiers on scout duty are moving through the forests of Dutch Guiana. The netting has nothing to do with camouflage. Its purpose is to keep off mosquitoes.

In the dark, steamy jungles of the tropics, Allied soldiers are fighting a twofold warfare—on the one hand against a wily enemy, on the other against hordes of mosquitoes. The mosquito is not a spectacular foe but he carries and transmits diseases sufficient to immobilise the most powerful army.

NOT all mosquitoes transmit disease, but those species which do, have to be combated vigorously. Most deadly of all is the species Anopheles, which carries and transmits malaria.

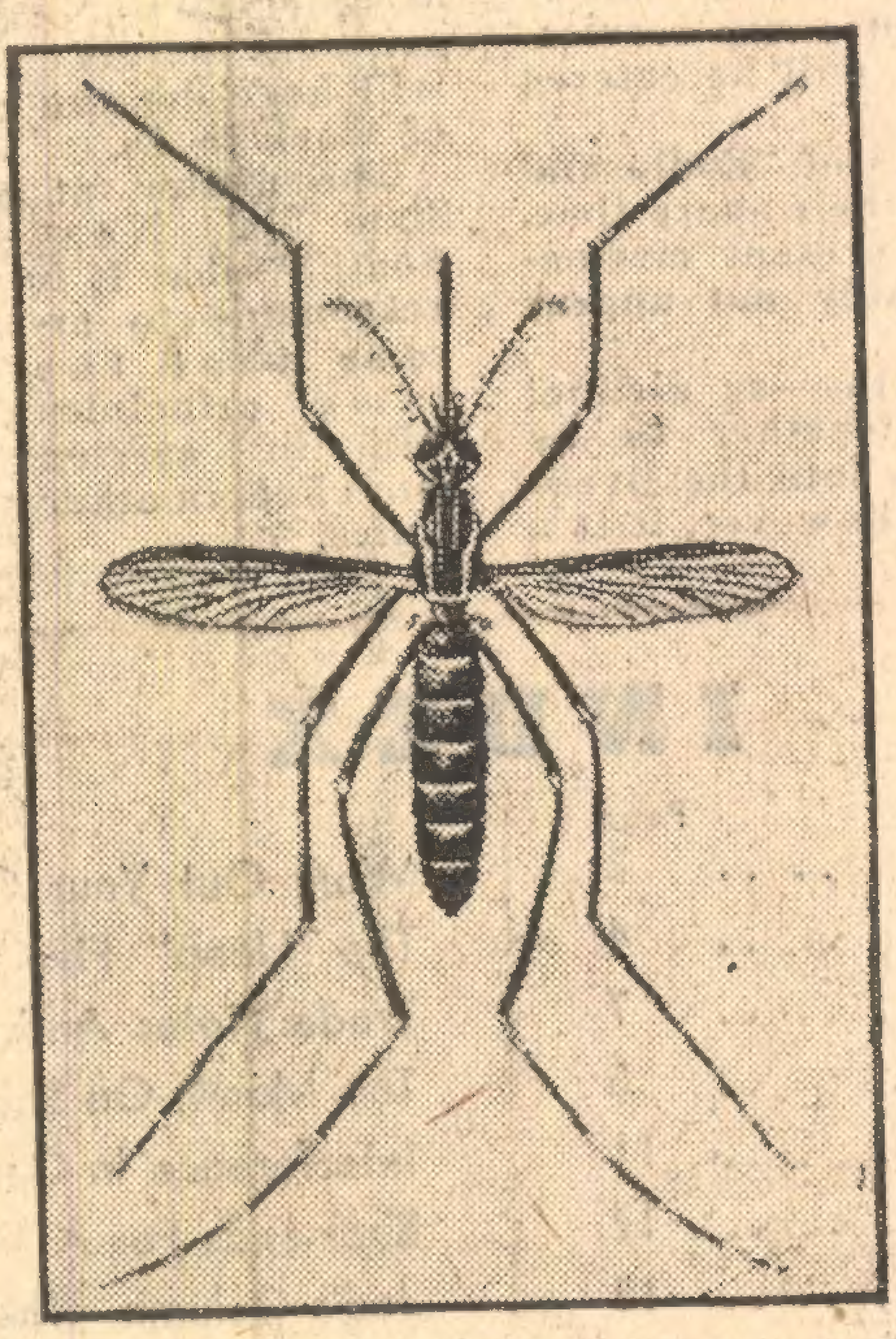
History tells how the French literally spent millions in a vain attempt to construct the Panama Canal. They failed, not because they lacked technical skill but because malaria and yellow fever sapped the strength of their workers. American engineers took up and completed the project simply because, in the meantime, they had come to realise the connection between the tropical diseases and the mosquito.

EARLY IDEAS

Previously, such diseases had vaguely been connected with swampland, with hot, damp jungles, with decaying vegetation, with bad air. In fact, malaria —"mala aria"—means bad air. The mosquitoes found under such conditions were looked upon merely as troublesome insects and it is only in comparatively recent times that their deadly role has been discovered.

As with most great discoveries, this one was made in several stages. A score of illustrious names may be mentioned. With the bacterial origin of disease—established by Louis Pasteur—ringing in his ears, a 35-year-old French scientist was on the prowl for the cause of "marsh fever."

Alphonse Laveran (1845-1922) spent untold hours in a tiny laboratory in a military hospital in Constantine, Algeria, examining the blood of afflicted soldiers. On a momentous day, November 6, 1880, he discerned tiny dark bodies in the red corpuscles of one of his patients. He sensed immediately that he had found the villain, because these same wiggling, microscopic forms (parasites) occurred only in the blood of those prostrated with chills and fever.



For a long time the mosquito was regarded as no more than an objectionable insect. It is known that certain species are the carriers for such diseases as dengue, yellow fever and malaria.

Subsequent observations served to confirm his epoch-making findings. Although he reported his results without delay, nine years passed before he was made a member of the French Academy of Science, and only in 1907 was he awarded the Nobel Prize.

But how did these minute "beasties" enter the circulation? Were they swallowed with food, or was a wound necessary? Laveran did not know. Hence he was unable to point the way to prevention.

As early as 1878, however, Sir Patrick Manson, a British Army surgeon stationed in Amoy, China, became convinced that the mosquito was responsible for the spread of numerous tropical disorders. He reasoned that the bite, which penetrates the skin, could introduce organisms of various types.

On his return to London, he aroused the enthusiasm of one of his younger colleagues, Ronald Ross (1857-1932), who had completed a tour of duty as a medical officer in India. On arriving in London he admitted that he was discouraged and disheartened over the ravages of malaria. Manson urged him to study the infection at first hand, and follow up the studies of Laveran.

CULPRITS FOUND

Adopting the suggestion, he retraced his steps to India, where he resumed his post with the Army Medical Corps. Two years of nerve-racking investigation then ensued—with his eyes glued to the microscope. But success was achieved. He identified the parasites in the stomachs of the species of mosquito called Anopheles.

Writing to Manson from Secunderabad under date of August 22, 1897, he said: "Can do nothing else but look at my pigmented cells (malaria parasites). Wonder if I am really on it at last. If not, what can these cells be?"

On August 31 he again wrote: "I really believe the problem is solved. . . I look at my cells daily. . . They are not found normally in the mosquito's stomach—only in those which have been

AGAINST DEADLY TROPICAL DISEASES

malariated (allowed to bite one ill with ague)." Then he repeated: "What else can the things be? I am not mistaken . . . I am on it."

Later he demonstrated the germs in the salivary glands of the insects, from whence they could enter the human circulation. In July of 1898 he worte: "I am nearly blind and dead with exhaustion, but triumphant." He received the Nobel Prize in 1902.

DISCOVERIES APPLIED

At the time that Ross was completing his work and rounding out his proof, the United States was at war with Spain. US troops were obliged to frequent tropical regions rife with mosquitoes, malaria, and yellow fever. It is safe to say that the brilliant conquest of the latter ailment by a group of courageous Americans could not have come had it not been for the earlier verifications that buzzing insects might be carriers of disease.

There followed an immediate and world-wide attack upon the mosquito. Commerce and industry, which had been driven out of the jungles, were now reestablished in healthful environments. Campaigns were inaugurated in Italy, Africa, the Malay States and in Central America.

DEBT TO ROSS

The technique employed at Panama reached a high state of perfection, and no one knew better than General Gorgas the debt the world owed to Ronald Ross.

Writing to Ross in 1914, Gorgas said: "Malaria was the great disease that incapacitated the working forces at Panama. . . . Your discovery that the mosquito transferred the parasite from man to man has enabled us at Panama to hold in check this disease and to eradicate it entirely from most points on the isthmus."

A long step forward was taken in 1923 with the creation of the International Malaria Commission. Today the affliction can be conquered if the means immediately at hand are used. The breeding plages of insects must be destroyed, houses must be screened, and those who are ill must be isolated.

EFFECT OF MALARIA

But what is the disease and how does it behave? It is prevalent in a belt of territory which encircles the earth from 20 degrees south to 35 degrees north latitude. The organism is called a "ulasmodium," and several varieties have been described.

The only way it can be contracted is through the bite of a certain species of mosquitoes, which in turn have fed upon the polluted blood of a human being or an animal.

The acute manifestation—a sharp chill—precedes a high fever and profuse sweating. Even before the "shakes" appear the victim will feel tired or complain of marked nausea. The shivering fit may be so violent that the bed will shake.

The coldness of the skin gradually gives way to heat, with the face and the body flushed. In severe seizures a splitting headache may be accompanied by delirium. Unless sufficient quinine has been taken to annihilate the active forms, a new crop of parasites will be hatched and the same episodes may be repeated at intervals.

The infection still exists, and we must rely upon quinine and other remedies to protect our fighters.

It was the Swedish botanist Linnaeus who named Peruvian bark "cinchona," in honor of Countess d'el Chinchon, who was largely responsible for the introduction of this panacea.

The World War II. has already demanded the presence of Allied soldiers and sailors in far-flung parts of the tropics. It may well be that the efficiency of our fighting forces will depend in large measure upon keeping malaria at arm's length. This will necessitate an adequate supply of quinine and other preparations and the strictest sanitary safeguards.

In Malaya, in Singapore, in New Guinea and in the northern parts of Australia, the AIF have done their share of tropical fighting. The picture shows a couple of Australian soldiers fighting their way through a Pandanus palm jungle during the Malayan campaign.

THE LUFTWAFFE RAINS DESTRUCTION

The Luftwaffe has tried to cripple Britain's railways. Buildings have been fired, great lengths of track torn up, bridges blown down. But the expresses continue to run and the all important troop, munition and freight trains. England owes much to the heroic band of men and women who keep the tracks open.

We have heard many songs of the "unsung" heroes of the war—the munitions worker, the transport worker and, of course, the taxpayer! But this article aims at removing the bushel that has so far covered the light of one vitally important section of transport workers—the men of the British railways.

by L. B. Montague

A FEW moments' thought might suggest some of the difficulties that must have been encountered by the British railways, but of the actual hardships and dangers involved, most of us know very little.

Even the people of England don't always realise, when the express slows down to a crawl on an open stretch of line, that only a little while before that very stretch of line was two 30ft. craters surrounded by a mass of twisted rails. Few realise that sixty men worked throughout a night-long raid by the flickering light of dimmed-out hurricane lamps to fill the craters and replace the lines; that 5 mph is about the maximum speed at which a train should be run above a newly-filled crater.

BOMBS, FIRES, TROOPS . . .

They cannot be told that the long-distance train stopped twice for half an hour in the early morning darkness because the driver and fireman were putting out a shower of incendiaries on the line or a flaming oil-bomb in the coal tender. They cannot be told for months that the train service to such-and-such a place was so unsatisfactory because many special trains carrying troops or munitions had to be fitted into the already overcrowded schedule.

Bombing has brought tremendous problems to the railways, but, even before the blitz began, the first blacked-out winter of the war put the whole industry to a tremendous trial. During the early months, for instance, the railway staffs not only had to adopt the system to blackout working and to carry out mass evacuation of thousands of civilians, but an average of 2300 special troop trains a month had to be worked on a rail system already heavily taxed with passenger and industrial traffic.

That was quite a test. But it was nothing compared to the job that followed—the evacuation of Dunkirk. Without previous preparation, the greatest sudden mass movement in the history of transport had to be organised—almost entirely by telephone. The railway companies pooled hundreds of locomotives, thousands of carriages. Controllers, signallers, shunters and drivers worked without sleep until they could work no longer. The result broke all records.

Within eight days 300,000 men were brought from the disembarkation ports. Over 620 special trains were run. At the peak, a hundred special trains were leaving the ports every twenty-four hours—one every fifteen minutes. And meanwhile ordinary passenger and goods traffic had to be maintained as closely as possible to time-table.

Two hard winters did not help the railways. At one time, in January, 1940, 1500 miles of track were blocked by deep snow-drifts; 300 snowploughs were working and thousands of soldiers and others helping to clear lines and dig out blocked trains.

Since those days the Luftwaffe has often concentrated on the intricate, delicate British system in an attempt to cripple transport. Their success has been small. They have, it is true, registered hundreds of hits on the system, causing local damage and sometimes delays over a wide area. But no national dislocation.

This is largely due to the efficient working of the system of Control Rooms which now handle the minute-to-minute direction of the main line and London transport system.

CONTROL CENTRES

There are many Control Rooms scattered over the country. Some far underground and safe from the heaviest bombs; some on the surface, but strongly fortified; all linked together, and with every railway point of importance, by a duplicate web of telephone lines.

Let us inspect a typical Control Room. It is underground, bare steel and concrete like an air-raid shelter; a complete air-conditioning system safeguards its workers from gas. Here at desks sit twelve Controllers, telephone headphones over their ears. Before each man is a large-scale diagram of a section of line.

A network of private wires connects each Controller with every station, signal-box, yard, depot, level crossing and other important points in his section. From these points information flows in by phone, and the movement of every train, engine or truck is recorded, from minute to minute, on the Controller's diagram by the movement of various colored pegs.

COMPLETE PICTURE

On these twelve diagrams is presented an almost instantaneous moving picture of everything that is happening over miles of track. And from the study of this picture the head Controller is able to send out orders to control the whole section.

Even in peacetime the organisation

BUT BRITAIN'S RAILWAYS CARRY ON

of non-stop and stopping, fast and slow, passenger and goods trains over a limited set of rails, to a rigid time-table, is a big job. But in war, when trains in a no-raid section are running at speed, and those just behind or in front are limited to an "alert" speed of 25 mph, when dozens of "non-schedule" specials—troop, munition, equipment, coal, food, hospital, evacuation—may have to be fitted at short notice into the already complicated, interlocking movement of trains; when 'phone calls may tell of lines cut in several places, of time-bombs endangering several sections, of signal boxes out of action or depots on fire, then the job of organising rapid aid and repair, while faced with the vast job of rescheduling scores of trains already on the move, would seem to the layman almost beyond human powers.

HOW THE JOB IS DONE

But it is a job which is done in Control Rooms with amazing speed. The Controllers and repair squads have been faced with hundreds of "incidents," each involving broken lines and signalling connections, scattered debris and deep craters, but in the great majority of cases the "service restored" notice has gone through within twenty-four hours, and often within three or four.

Here is a picture of how the Control and Repair systems go to work. It is built up from several actual cases.

The Controllers are on duty in their underground room when an early alert is telephoned through to them from the Post Office. They pass the warning on to the key points in the various sections. Then they resume their ordinary routine work and wait for incidents to come through.

Out on the steel lines the "incidents" are already happening. A big h.e. bomb whistles down near a small signal box, partly wrecking it, trapping the signalman and setting the woodwork on fire. Farther along the line a stick of bombs falls squarely, tearing up maybe a hundred yards of rails. Smaller time-bombs are embedded in the embankment and may go off at any time.

WARDEN CARRIED ON

Reports of the first "incident" are slightly delayed. The Railway Warden who went out to investigate after the explosion found the signalman trapped in his burning cabin. It took him fifteen minutes to smother the flames and release the wounded man. Then only did he turn to the phone to call an ambulance and report damage to the Control Room.

For the next half-hour the Warden himself worked the signals, while the wounded man, lying on the floor, told him which levers to pull. An ambulance and a relief signalman, despatched by Control, arrived simultaneously. The work of the damaged signal box went on. The Warden returned to his post to await other reports.

A trip by rail is a diversion for troops, an opportunity to let their feelings run riot. But for the railway authorities the movement of large numbers of troops is a major problem. Rolling stock has to be located and mustered and the trains have to be fitted into an already overcrowded schedule.

Back in the Control Room preliminary reports of the damaged track have long since arrived. Now an inspector is phoning through exact details of the extent of the damage. The Controller gets in touch with the engineering section, reports the exact section damaged, and leaves it to them to decide whether repairs can be carried on during the raid.

TRAINS DIVERTED

Meanwhile several Controllers are busy "sealing-off" that stretch of line and redirecting scores of trains so as to by-pass the bomb-craters. A complex business, this, for one heavy bomb on a vital track may affect traffic over hundreds of miles. Several Control centres must get in touch telephonically and co-operate to work the diverted trains into an already crowded time-table on the substitute route.

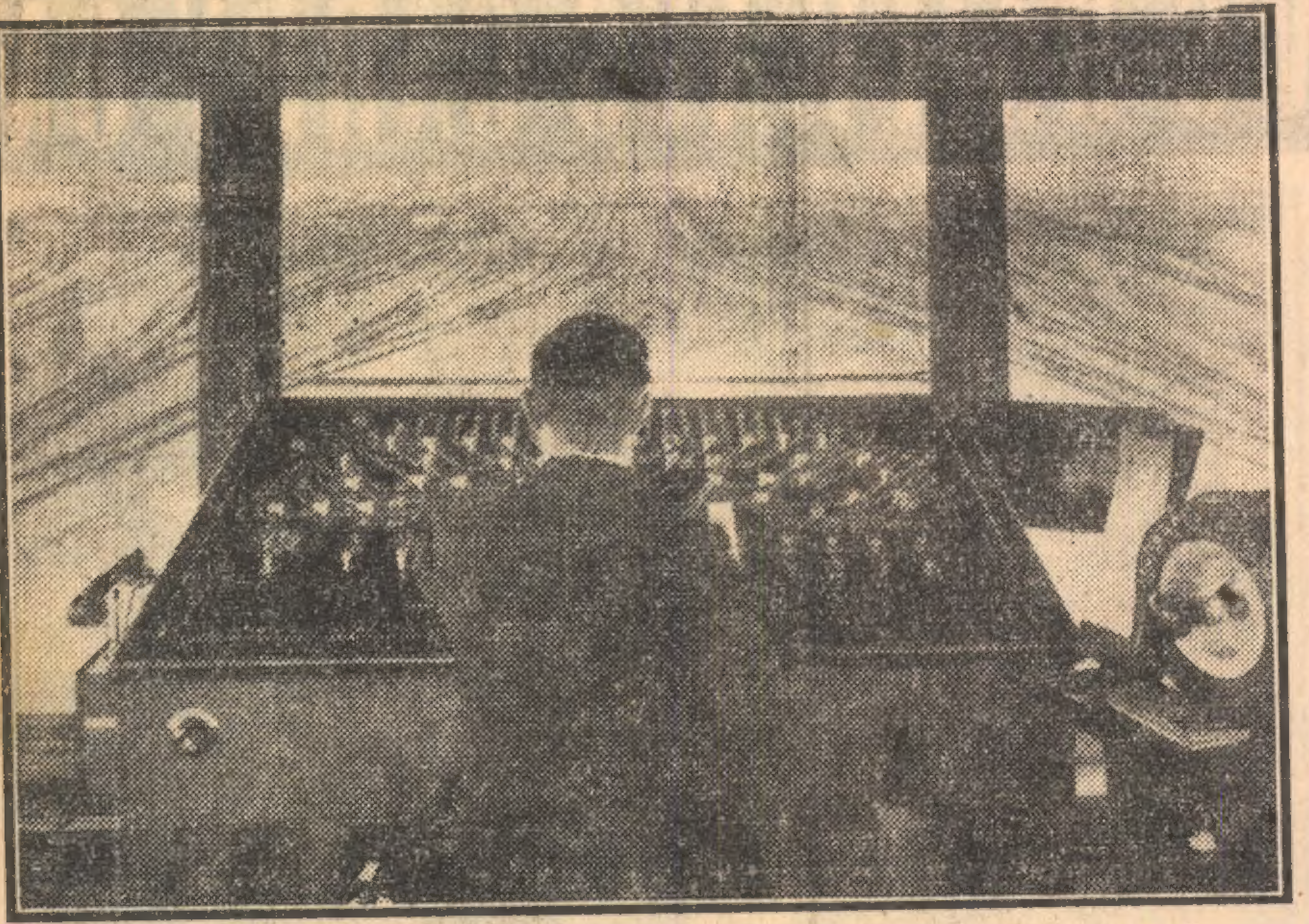
In the Engineering section they consult the big filing cabinets which contain plans of every section of line, every bridge, signal-box, crossing, set of points, signalling section, station and every other construction which may need to be replaced. This particular incident is

(Continued on Next Page)

This is what happened when a heavy bomb scored a direct hit on a railway bridge. The wreckage is enough to daunt even the most stout-hearted. It is a tribute to Britain's railway workers that damage such as this has been repaired within a day or so, sufficient to provide a temporary service while the bridge was being rebuilt.

FEATURE STORY

SORTING OUT BRITAIN'S FREIGHT TRAINS



Seated at the control desk overlooking the marshalling yard, the man in charge of operations looks more like a cinema organist than a railwayman. Loaded goods trains are drawn up an artificial hill and the trucks uncoupled singly or as required. As they run down the incline, they are diverted into various sidings, depending on their destination. A 60-waggon train can be cut up into 40 parts in $6\frac{1}{2}$ minutes.

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a fairly straightforward job. Just three deep craters to be filled, tons of debris collected, broken, twisted rails to be removed, new ones fixed, and tried and ballasted, and some lengths of signalling to be replaced.

They decide that the men can begin work with their dim, shaded hurricane lamps. Fortunately a quarter-moon later in the night will help with the job of relaying the rails.

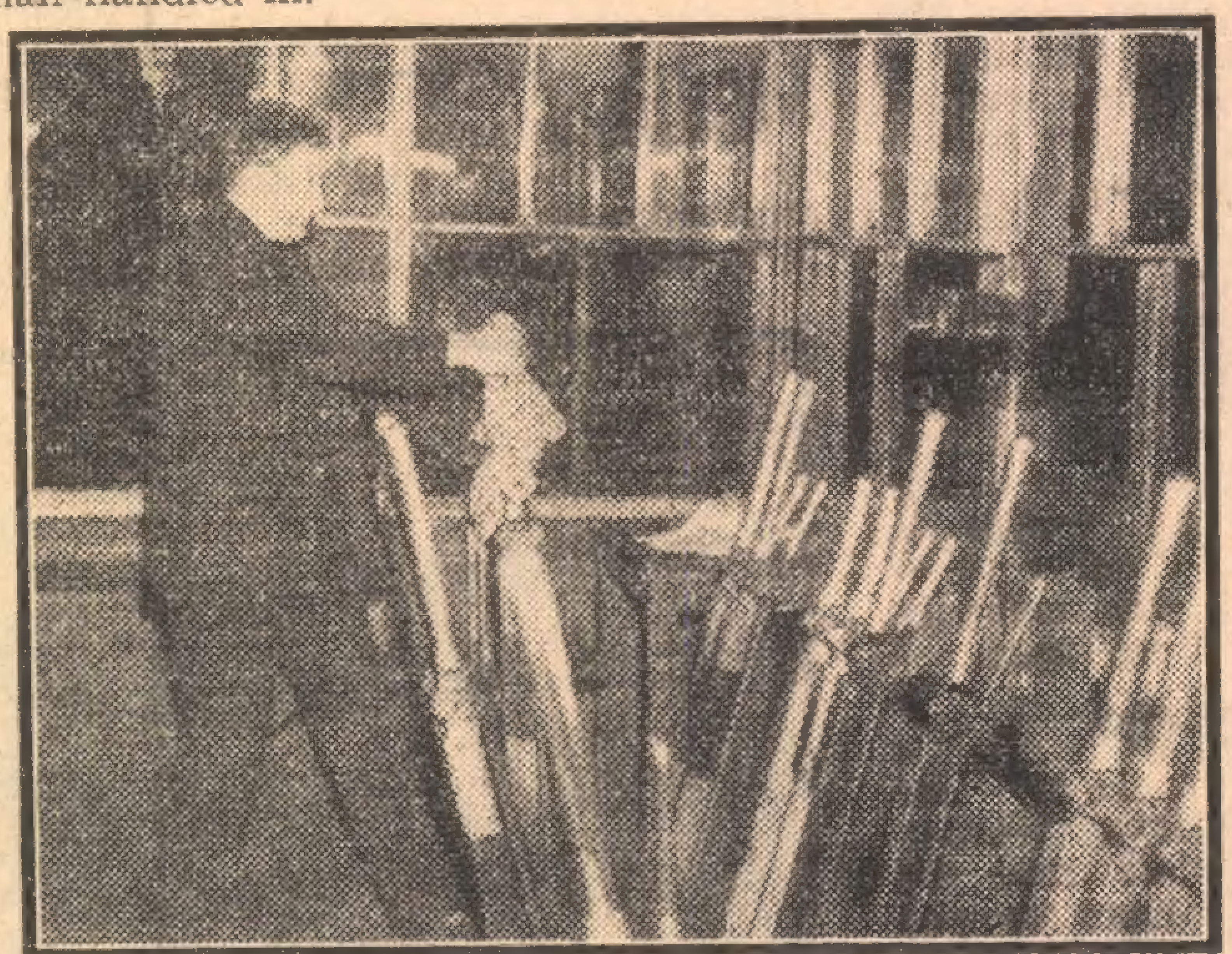
So in conference with the Controller, Engineering gets in touch with the yard where a laden repair train is always waiting. As this is a straight job, no special parts are needed other than those already loaded on the train, but, if they were, Engineering would identify them from its plan of the damaged section and phone details to the yard, where the parts would be taken from the huge "spare parts" store and loaded up.

REPAIR TRAIN

Meanwhile, Control Room works out a route for the Repair Train to take, phones directions to its crew, and warns signalboxes on the route to pass it through. Within a few minutes, it is on the way. Twenty waggon-loads of coal and car ash—the ideal filler for craters, since it packs and drains well, and exists in unlimited quantities on any railway system. Breakdown waggons, fitted with cranes and hoists, jacks, lifting-bars, blow-lamps to cut through rails; trucks filled with 60ft. lengths of rail, sleepers, bolts and wedges.

Railway breakdown crews are always on duty, and some men may go with the train. But others are needed for this job. So they must be fetched, and quickly. Armed with addresses, half-a-dozen railwaymen set out to bang on front doors and fetch extra workers from their supper-tables or beds; to rout men out of homes and clubs, to summon them, by a message flashed on the screen, from cinemas. Leisure is not sacred when the tracks are cut.

The Repair Train steams as close as possible to the scene of the damage. Often it is possible to use an adjoining undamaged line, so that the waggons laden with ash can tip their load straight into each crater. If not, it must be man-handled in.



Under wartime conditions, the job of a signalman is a very exacting one. His box is a good target for roving bombers. He has to cope with all kinds of emergencies, with fire, with bombs, with snow in the winter and with trains operating under makeshift schedules and at irregular speeds.

In this case about sixty men got to work on the destroyed line at about eight in the evening. The raids were still on. Nazi planes hummed continuously overhead. Bombs whistled and shook the earth. A spattering of shell splinters fell intermittently. The time bombs lay nearby. But the work was never interrupted.

By the dim, flickering light of hurricane lamps, the damaged rail-ends were detached, craters rapidly filled with tons of ash, new sleepers were bedded down. And then the gangers, working in rehearsed teams of twenty, instantly responsive to the hand signals of their leader, lifted the 60ft. rail lengths, each weighing a ton, and carried them into place, ten men on each side, the rail slung from bars. The rails were placed roughly, then exactly aligned, bolted and wedged firmly.

Other men were clearing the debris which blocked the nearby lines, lifting the heavy bits with the breakdown crane, the light ones by hand.

LINES OPEN

The bombs had fallen in the early evening. Repair work started at eight. Before midnight the lines were open again. Next morning trains would pass again, at 5 mph, over the spot where the bombs had fallen. Only the new-looking sleepers indicated that an "incident" had happened.

These, and the couple of ballast men waiting to shovel ballast beneath the track as each succeeding train depressed it an inch in passing. Their job would continue for a week or more, until the weight of traffic had packed the filled crater solid.

Such incidents already fill many books in the railway offices. They tell of hundreds of craters filled and tracks relaid within three or four hours, in time for the morning rush.

ACTUAL INCIDENTS

Some jobs take longer, of course. In one early-morning raid, for instance, a four-track bridge was damaged. This had to wait until dawn, and it was not until 6 pm that the service was resumed. But in that time a new cross-over 250ft. long was built, high tension cables were moved and entrenched, and automatic signalling over two miles of track was reversed.

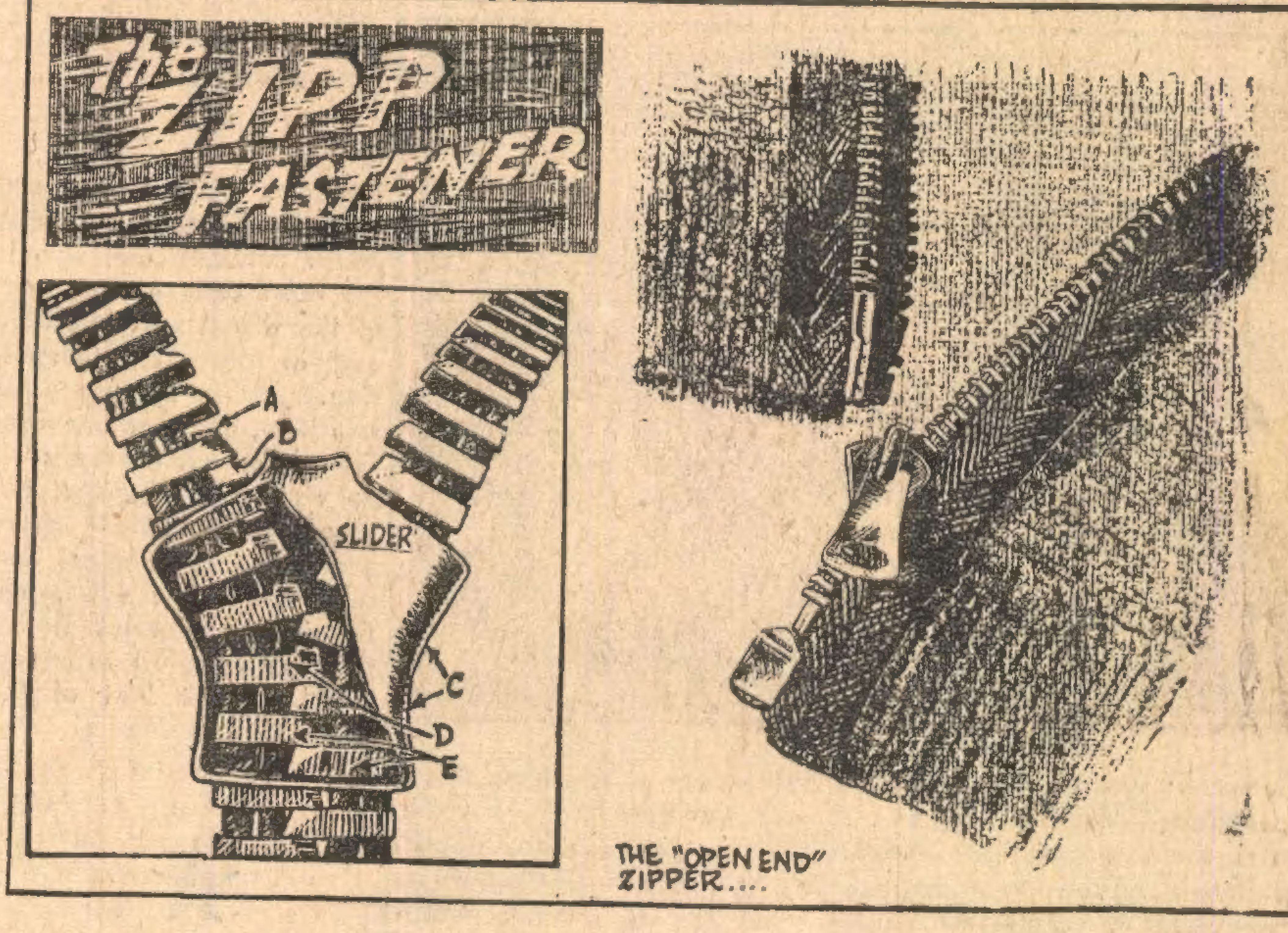
A viaduct was pierced by a bomb, which blew a crater in the eight-line track, shattered one arch and its piers and badly damaged its neighbors. This was a really tough job. But within a few hours two emergency lines had been laid across to carry vital traffic. Then gangs worked day and night to pack the shattered section of viaduct with earth, until it was transformed into a solid embankment able to bear any weight.

So far we have spoken mainly of efficiency and the results produced by the railway workers. Much courage is called for from the gangers who work through the night raids, and the number of reported cases is mounting up. Here are a few. **(Continued on Next Page)**

"HOW IT WORKS"—BY R. M. YOUNGER

It is many years since the principle of the "Zipp" fastener was first discovered, but it is only comparatively recently that the gadget was perfected.

NOW, from being a plaything and a "crazy" unnecessary, the zipper has become a valuable adjunct to industrial clothing, eliminating easily-broken buttons and "ends" that could catch in moving machinery. The fighting Services find the zipper has special qualities as a fastener on "active service" clothes.



SHAPED TEETH

Have you ever wondered just how the zipper—the modern button—works?

If you carefully look at the zipper's teeth, you see that each has a bulge on the upper side. You will see this in the sketch, A, in the lower left-hand diagram. There is a corresponding depression or hollow on the under side ("B"). The bulge and the depression are angular, and are so made that, when a tooth is pushed between the opposite teeth **at the exact angle** by the slider, there is just enough space for it to enter.

Then, as the slider is moved up, the teeth are straightened out, and this makes the bulge engage firmly in the hollow of the tooth above. The line so locked together cannot be pulled apart because the teeth, kept squarely opposite each other, cannot slip out.

The exact angle necessary for closing (and opening) the teeth is shown at "C" in the diagram. "D" shows the teeth partly engaged, and "E" teeth that are fully engaged.

The zipp fastener was originally invented, in crude form, in 1893. Regular manufacture began in 1913 in the United States, but it was many years before the zipper became popular.

The "open end" idea, by which the two sides of the garment or other article to be joined by the zipper, was developed a few years ago. It was a big step forward, as was the perfection of a smooth-running type of fastener.

Most zipp fasteners have been made of brass, some with nickel finish. Latest development, however, is the introduction of zippers made of plastics, in various colors. Before the manufacture was restricted, these were available for matching the tones of women's garments on which they were used.

Britain's Railways Carry On

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Three signalmen were working by night in a big cabin which passes 2000 trains a day. They heard a bomb whistle down and ducked as it crashed off a wall of the cabin and buried itself in the earth. They weren't quite sure it was a bomb, so one of them climbed down and groped about in the dark till he found something. He ran his hands over it. There was no mistake.

STILL ON DUTY . . .

He went back and reported. The head signalman glanced at the big illuminated panel which records the movement of trains over routes of track. It was still winking. "It's still on duty, and so are we," he said. And so they carried on for an hour, within a few feet of half a ton of TNT and clockwork set to go off at some time unknown. Eventually, Control Room ordered evacuation. But they didn't leave until they had all their trains in.

A 50-waggon ammunition train, standing on a siding, was hit by incendiaries. From his bedroom window a railwayman saw that two trucks were blazing, and threatening to send off the rest. He helped a couple of neighbors to safety, vaulted a fence, unhitched the two burning waggons due to explode at any moment, and with the help of a mate shaved them along the track away from the rest of the train.

A bomb fell on a siding right outside a cordite magazine, and set fire to two trucks at the loading platform. Three railwaymen who ran up, armed only with hand pumps, found that flaming fragments had jumped into the magazine itself, and had already set the case of a cordite container on fire. Surrounding boxes were beginning to char.

BOMBS WERE REMOVED

Here, if ever, was an excuse to run. The men ran, but they ran into the building. The report goes on to say "The fire was then extinguished."

An incendiary fell on a truck containing high explosive bombs. By the time a railwayman arrived with a stirrup pump, the top layer of bombs were already almost too hot to handle. The incendiary had slipped down out of reach and was spitting fire in all directions. An explosion was inevitable, unless the bombs were removed.

They were. One by one—until the incendiary was uncovered and the stirrup pump could come into action, first to cool the load of bombs, then to extinguish the blazing thermite.

It would be possible to go on for pages telling how petrol and explosive trains have been shunted through flaming buildings to safety. How volunteers shunted a goods train alongside a huge time bomb to screen main-line traffic if it exploded; how a signalman, blown across his cabin, carried on with a double fracture until help arrived.

STRAIN ON DRIVERS

In peacetime, the driver's job is a worrying one enough. In war, it is really a nervous strain.

Side windows are blocked out and cabs covered with tarpaulin to hide furnace glare, only the small forward windows being left. Not only must the driver watch for ordinary signals, but also for the emergency warnings which tell of newly repaired track. A faintly-illuminated figure "5" flickering past the window means that he must be prepared

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THE RIDDLE OF THE FOURTH DIMENSION

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Professor Albert Einstein, the world-famous scientist and mathematician, who is the most eminent exponent of the theories of relativity and of the fourth dimension. Einstein's theory of relativity, more or less confirmed by photographs of an eclipse of the sun, cut across and upset many accepted astronomical calculations. We will leave the theory of relativity to those who profess to understand it, but that of the fourth dimension gives a lot of food for thought.

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Many years ago a philosopher said that "there is nothing in this world or even in existence that is unknowable. There are, merely many things that are not yet known." And in truth this must be the philosophical foundation on which science rests, for, were it otherwise, the urge to seek would cease and scientific achievement would rest on a foundation of accident.

by Calvin Walters

IT is this philosophy that certainly must have actuated Albert Einstein when he threw a spanner into the works of gravitational theory by the announcement of his theory of Relativity. Many were the books that were printed in "popular" language for the multitude to read and gain an understanding of this breath-taking discovery.

Unfortunately, these "popular" expositions were not so "popular" after a time and the whole question of Einstein's reasoning was left to the scientists to work or fight out.

THEORY CONFIRMED

Thus, we had these worthy persons running all over the globe with their telescopes, &c., chasing any eclipse of the sun that happened to be around. For did not Einstein say that light was subject to the force of gravitation and would be bent when it passed a nearby object, such as a planet?

So they began by taking photographs of a star that was visible near the sun during a total eclipse and another photo of the same star at night time when the sun was not around; they reasoned that, if the light was bent on its way past the sun, the position of the star should be different in the two photographs.

And so it was, and Einstein had a victory, much to the disgust of a number of scientists who had spent quite a lot of money trying to prove friend Einstein wrong.

For that is the way of a lot of scientists. They nurse a theory for so many years that any threat to the validity of that theory is to them a major disaster. Rather than spend money helping to prove the new theory RIGHT, they would rather spend it proving it WRONG, which doesn't make sense to me, especially if the new theory helped to find some more of the "not yet known."

However, to get back on the track again. After a lapse of years, the general public lost interest in Albert E. and his theories.

But there was one side of the question that captured the popular imagination. This was the mention in the Relativity Theory of a possible fourth dimension. Einstein mentioned something about our " . . . own universe is but the curved surface of some figure existing in space of yet another order."

What he meant by this was that we live in a world in which everything can be described by the giving of three dimensions. But there may be another, a fourth dimension, and our universe may be the curved surface of some figure in this fourth dimension.

FLIGHTS OF FANCY

You know, when I was a youth, one of my fondest dreams was to be able to make myself invisible. I was not alone in this ambitious scheme. But I thought I was at the time, and later, when I read H. G. Wells' "Invisible Man," I was annoyed with him for pinching my idea.

There are many people who want to make themselves invisible. Look at all the people in gaol. There are also the peaceful people, like myself, who would like to stop the war and invisibly do away with the men I thought responsible for it. Unfortunately, if we all did away with those whom WE thought responsible there would none of us alive to see the results.

Then there is the man with the ulterior motive of getting rich quick, who would take what he liked when he liked.

What about the punter at the races who could invisibly ride on the same horse as the jockey to add a bit of weight when the horse on which he has his money seems to be a bit behind.

DOMESTIC APPLICATION

Then, of course, one could follow his wife around when she goes shopping and invisibly take the money out of her handbag if she looks like spending too much.

Oh, the idea has all sorts of possibilities. The only catch, as far as I can see, is accomplishing it, and then preventing anybody else finding out how to do it, for then the thing would be useless.

Is it impossible? Maybe the fourth dimension will help us. So let's get on with it.

To study the fourth dimension we will have to begin with one dimension. According to mathematical ideas, a point has no dimension at all; it is merely a position in space without length, breadth, or thickness.

Now, if this point in space moves, it will generate a line, also without dimension, except that of length. I want you to imagine one of these lines. In fact, before we are through, you will be called upon to imagine a lot more things, so you may as well start now.

IMAGINE A LINE . . .

So we imagine a line having length only. If you like, we can draw a line and forget about it's thickness; here it is in Fig. 1.

I have divided this line into four equal parts of which I will speak

WHAT FACTS LIE BEYOND OUR GRASP?

later. Also, you will notice a dot on the line which represents an animal which also has nothing but length. This animal is moving on his one dimensional line, which is his universe. His universe is one dimensional and so is his mind. He can conceive of nothing but length, length, length.

As the animal can't turn round—if he could he would be two dimensional

Figure 1. Imagine—if you can—an "animal" with a one-dimension mind and physique. He would have length only and would only be able to move and to think in terms of the one direction. To him a two or three dimensional animal could appear or disappear at will. Without knowing it he might be moving on the circumference of a circle, a path without beginning and without end.

—he must keep going. On his way to nowhere he says to himself, "Am I ever going to reach the end of anywhere? Is there an end to space, for I can't go on forever, and yet obviously I can't stop? For no matter where I imagine the end to be, I can imagine more line beyond it."

MOVING ON A CIRCLE

What a predicament! Yet if there were any people living beyond him in a TWO dimensional universe, they would see clearly what might be happening. The animal might be on the circumference of a circle. Of course, he wouldn't know, not being able to see up or down or round, or even to imagine such a thing. It is obvious also that anyone living in the second dimensional world around the animal would be able to appear and disappear at will in front of the animal.

Look again at Figure 1. If you bend the line round at points B, C and D you get a square—a two dimensional figure (Figure 2).

Now perhaps you can take your imagination a bit further and think of a two dimensional animal. There he is in the centre of the square. He has a two dimensional universe and a two dimensional mind. He knows of nothing but length and breadth.

TWO DIMENSIONS

It is obvious that he is absolutely imprisoned in his square, for he can't get over the line without climbing over, and this would require a knowledge of three dimensions. WE could tell him how to get over, but he wouldn't believe us. In fact, if you spoke to him from above he would begin to evolve a theory about spiritualism, for he couldn't see you. That is what we have done, haven't we?

This two dimensional animal couldn't tie a knot in a piece of string. He could bring one end into the form of a circle, but he couldn't bring the end over and through to form the knot. Again, if one of we three dimensional animals came along from above him and slipped the string over and through and completed the knot, he would believe in black magic also.

Perhaps now you can see the drift of the argument. But let us go on. We saw that the one dimensional line could become a two dimensional square by bending it around in appropriate fashion.

If we take the two dimensional square and add a square on each side and another square beyond, as shown in Figure 3, we should get a plan of a three dimensional figure. And so we do!

If you fold this two dimensional plan up you will get a three dimensional cube. There is no need to imagine a three dimensional animal, for we are it. We live in a three dimensional universe and just as the one dimensional animal could not imagine a two dimensional universe, and the two dimensional animal could not imagine a three dimensional one, so by analogy we three dimensional animals cannot conceive of a four dimensional universe.

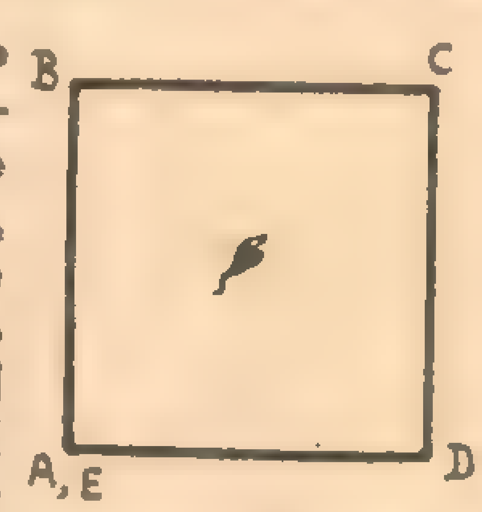
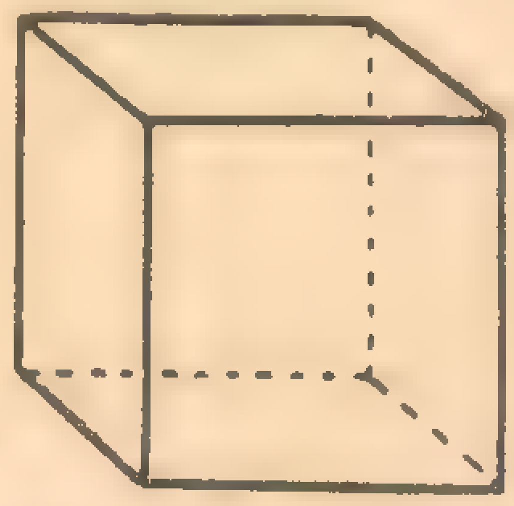


Figure 2. A figure having two dimensions may be made by folding up a line, which has only one dimension. A two dimensional animal could be imprisoned in such a figure by virtue of the fact that he could not climb over the line to escape. That would involve application of the third dimension of which he has no knowledge.



But that is no reason for being dogmatic about the denial of one. Just as we drew a two dimensional plan of a three dimensional figure, we ought to be able to draw a three dimensional plan of a four dimensional figure.

Well, here we come to the catch. It will be remembered that to draw a two dimensional plan of the three dimensional cube, we added a square on each side and one beyond.

It seems then that to draw a three dimensional plan of a four dimensional figure, all we have to do is to add a cube on each side of the first cube and one more beyond as shown in Figure 4. This is our three dimensional plan of a four dimensional figure. The catch is how does one fold it up to make our four dimensional figure?

It is not much good saying that it can't be done. WE can't do it, not at present anyway. But if a fourth dimensional world exists, perhaps someone in that world could show us how, if we could get in touch with him.

IMAGINATION AGAIN

But our minds are only three dimensional and, for the present, it seems that we are to be confined to our three dimensional world, and that we are to mind our own business for the time being. Perhaps, when we have cleaned this world up a bit, we may find time to play around with fourth dimensions.

I assume that by now your imagination has been so stimulated that you can stand a little more. Well then, how do we know that there are not a lot more three dimensional worlds infinitely close to us?

An analogy will help to make clear my meaning. Hark back to the flat animal inside his square. He is two dimensional. But let us assume that he does not live on the surface of a square or slab. He could just as easily live on a closed surface, such as a sphere. (See figure 5.)

NO BEGINNING, NO END

The flat animal would deny that he is living on the surface of a sphere, as it requires one more dimension than he can imagine. The surface of the sphere is two dimensional, but it possesses a curvature in a third dimension.

However, just as some of us will deny the possibility of a fourth dimension, so the flat animal will deny the possibility

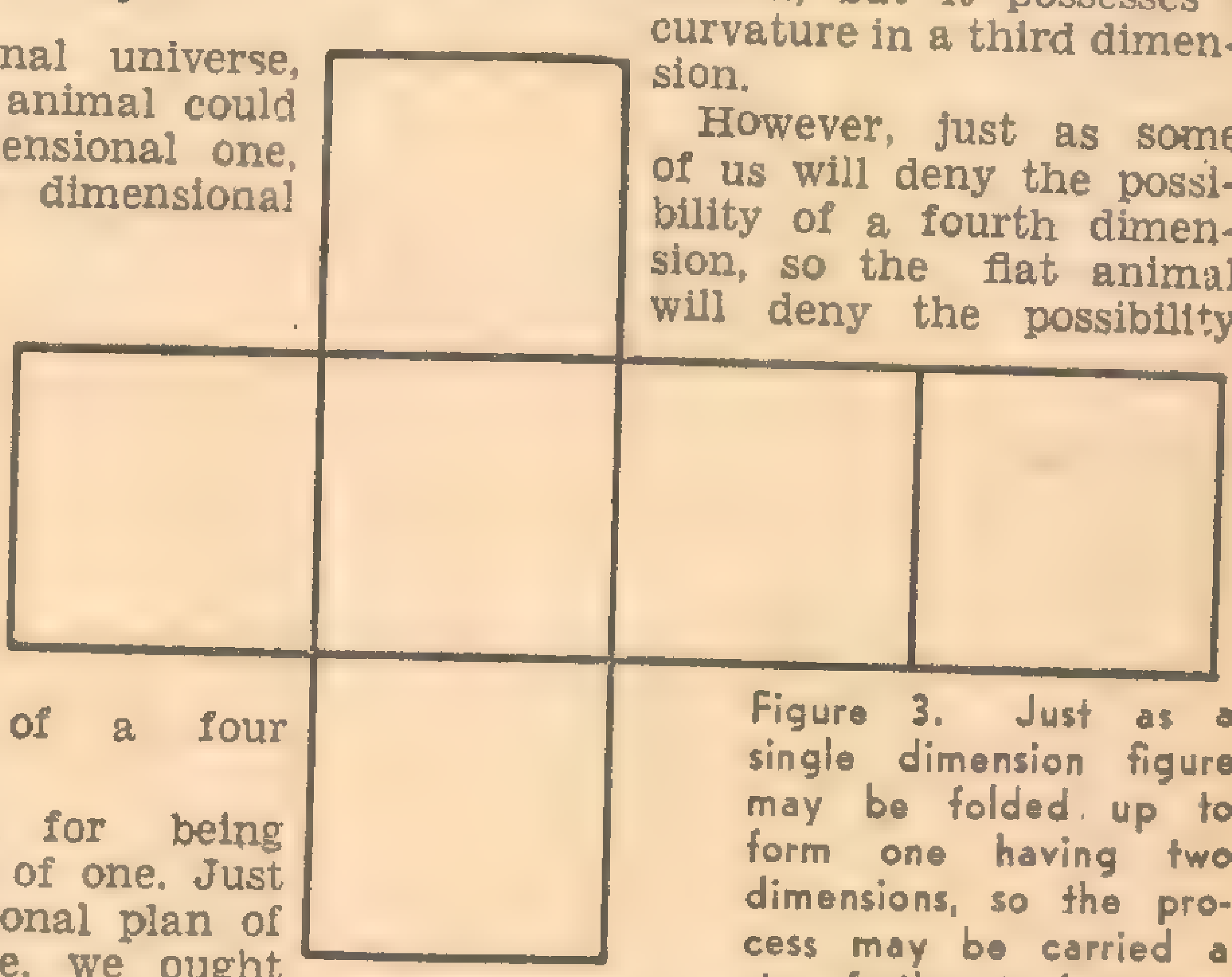


Figure 3. Just as a single dimension figure may be folded up to form one having two dimensions, so the process may be carried a step further to form one having three dimensions. We three-dimensional creatures are quite at home up to this stage of the argument.

(Continued on Next Page)

of a third dimension. Yet it would offer a solution to his problem of how he can go on forever.

It is similar to the single dimension animal on his circle. Just as a circle is a one dimension that neither has beginning nor goes on forever, so the sphere is a two dimension figure that neither has beginning nor goes on forever.

Now, if the flat animal was inhabiting the space between two concentric globes he wouldn't know about it; no matter how close the second globe was to him, he just couldn't see UPWARDS onto the inside of the outer globe.

UNKNOWN NEIGHBORS

Nevertheless, the fact that he couldn't see it would not prove that it was not there. In fact, this outer globe could easily be inhabited by more flat animals and they, in their turn, wouldn't know about the inside globe because they couldn't look downwards.

To carry this a bit further it is possible for both the inside and the outside of the globes to be inhabited by two dimensional animals and no matter how thin the walls or how close the globes, neither would know of each other's existence.

Even if they could hear one another, they could not, with their limited two-dimension minds, comprehend whence the sound came. At best it would only lead them to suspect the existence of some other unknown dimension.

So with us. A careful study of all that I have written here should imbue us all with a sense of humility in view of our very probable limitations.

Here we are, in a three dimensional universe, and we behave as if we know all about it, when all the while there may be a fourth dimensional universe outside us to which we owe allegiance. I don't know if we can give it a name. Our own three dimensions are length, breadth, and thickness.

OUR LIMITATIONS

We could call the fourth one space or time. Some people could call it God. Others may call it Nature. But whatever it is called, one cannot very well deny the possibility of its existence.

Of course, there is no reason why we should stop at the fourth dimension. Why not five or ten or a hundred? Who are we to say that there are or are not these "extras."

Human reasoning power is something that may well have a border line beyond which lies—what?

Nevertheless, this question of a fourth dimension is something which will not be forgotten until something is done about it. It may be thousands of years before something IS done about it. But the scientists will never forget it.

There is one exciting possibility about the whole business. We have all read highly imaginative tales of space ships travelling to other planets, and so on.

If the fourth dimension is ever really discovered, and its characteristics mastered, then it may be that we can go and see our relations up in Venus or Neptune. It seems reasonable to suppose, anyhow.

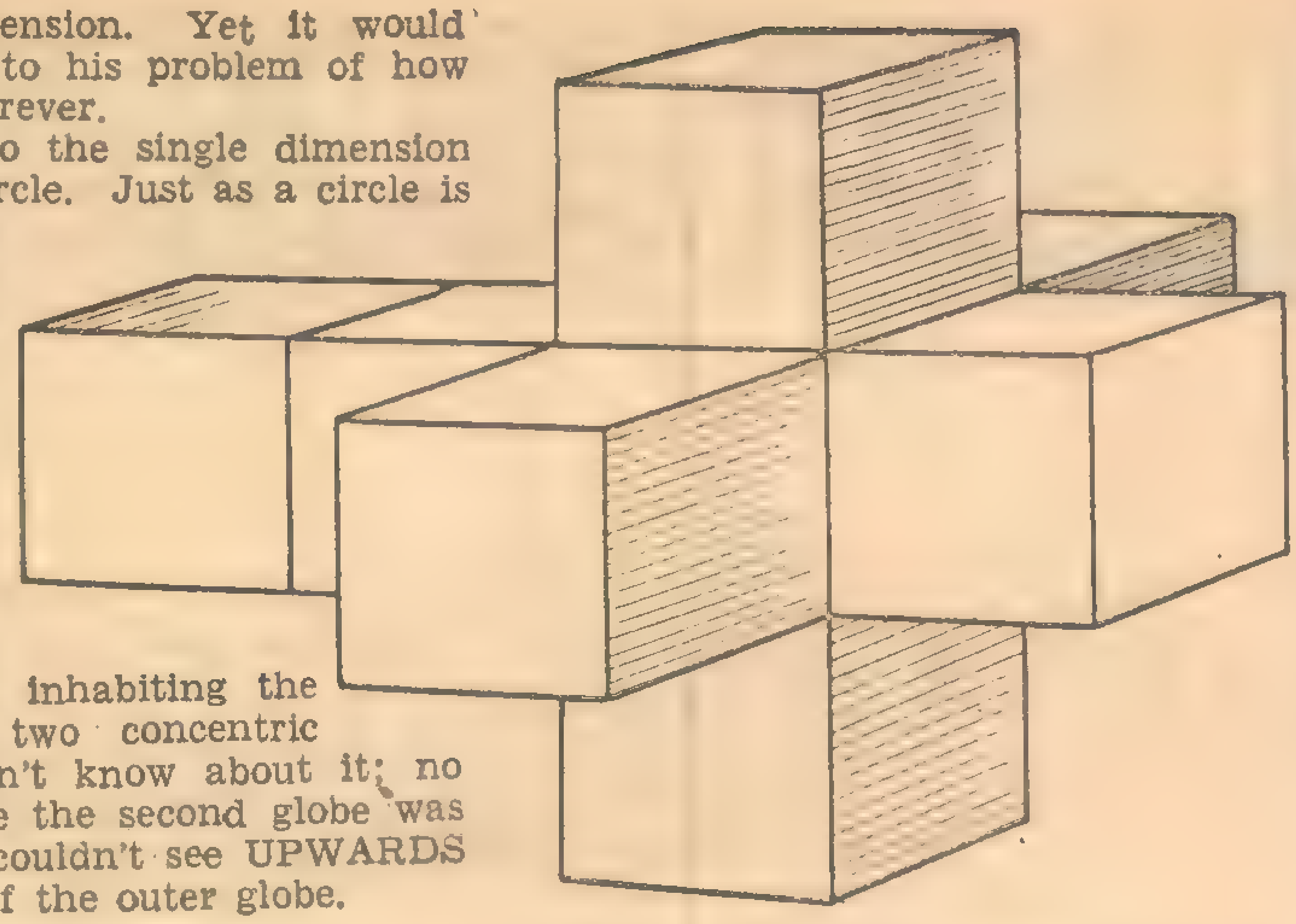


Figure 4. It is quite a simple matter to fold up figures having one or two dimensions. When it comes to folding up a three dimensional figure we are stumped. Our minds simply will not carry us past this point.

For if a two dimension being can appear and disappear at will to a one dimension person, then we might do the same with the fourth dimension. There is only one thing that takes the glamor off it, and that is the possibility of meeting someone there that you thought you had seen the last of down on this three dimensional world. But no doubt this angle of it would also have its pleasure as well as its pain.

Figure 5. Living on the surfaces of concentric spheres, two bi-dimensional animals would be entirely ignorant of each other and of each other's world. By the same process we may be surrounded by other creatures, intangible and unknown because they are separated from us by a dimension of which we have no knowledge.

WHAT OF TIME?

Of course, TIME has been called the fourth dimension. Certainly, time is a dimension, and it is a necessary one, even in this third dimensional world of ours.

One could not very well imagine an object that did not exist in time, although I wouldn't be surprised if you could imagine almost anything by now.

If an object did not exist in time as well as in length, breadth, and thickness, then it would be timeless. In other words, it would not exist at all. Certainly, an object COULD be timeless to us in the sense that its existence was so short, say, one billionth of a second, that we could neither see, feel, hear, smell, or taste it, be it as large as a house.

These objects may be all around us, coming into being and living again so fast as to be indiscernable. Yet they would not be really timeless.

IN CONCLUSION

It seems natural, then, for us to think of the fourth dimension as something tangible. Something real. Maybe it is that mighty force that keeps the universe in being and that beyond the fourth dimension there is another force as incomprehensible to the fourth as the fourth is to us.

In the meantime, there are more pressing and urgent affairs for the world to settle. It may be as well that in the present state of human insanity, the fourth dimension has not been discovered, for it is certain that it would be used in some destructive fashion in the process of constructing some "new order."

Britain's Railways Carry On

(Continued from Page 7)

to slow to that speed. Farther on, his straining eyes make out a dim "C" for "commence," and from here until a welcome "T" for terminate, he must creep at walking speed along the newly-laid rails as they sag beneath the weight of his engine.

A word is due, too, to the men who run Britain's vast marshalling yards, where long trains of waggons are split up and the waggons sorted out separately in perhaps a score of different sidings. In peacetime, these were a blaze of light. Today, thanks to automatic devices, the work can continue in almost total darkness.

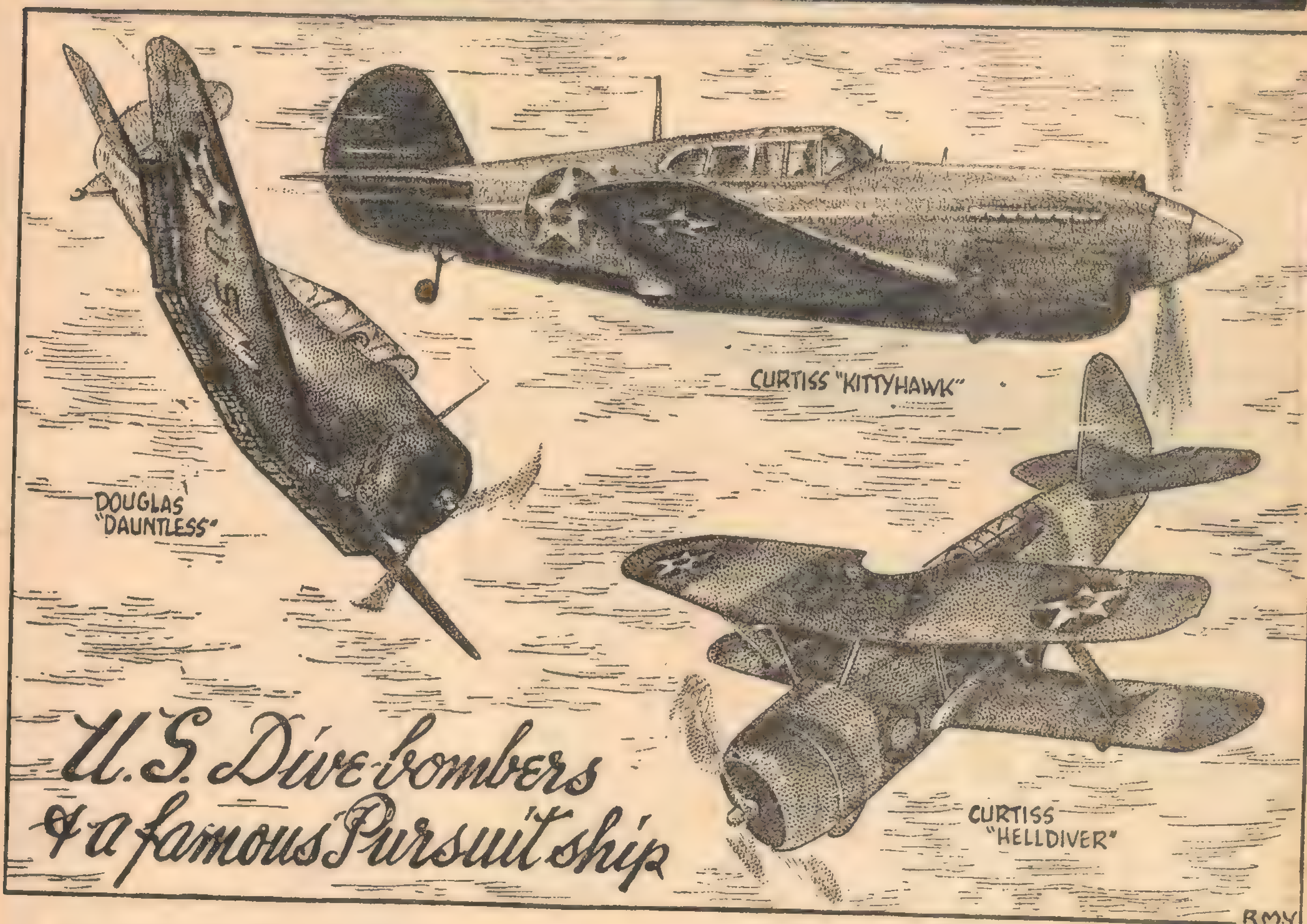
One man, sitting at an indicator the shape of an organ console, can "watch" and control the movements of each waggon, as it rolls down the rails of the yard, and steer every one onto a different siding by the touch of a button.

This is vitally important work, when no idle waggons can be tolerated for an unnecessary hour. If, and when, bombing of our own capital cities becomes an actuality, Britain's experience will be invaluable to our own railway systems. And we need not doubt that the same resource and courage displayed by Britain's workers will characterise our own.

SHOCK FOR CALVES

FOR some years cows have been milked by electricity. The same power may now be used to wean calves. There has been patented in the United States an electric weaning device which includes a kind of head-stall with a switch unit adapted to be mounted on the nose of the calf. This, we presume, by giving the animal mild shocks, eventually induces the bovine suckling to abstain from its first source of nourishment.

AIRCRAFT OF TODAY — BY R. M. YOUNGER



In the latest attacks on the Japanese by U.S. planes, and in the air war over Europe, the superiority of the newest American designs has been written down in the form of enemy losses.

SKETCHED at left is the US Navy's formidable Douglas "Dauntless" dive-bomber, which has already been reported in action in the Pacific. It is claimed to be superior in performance to any other single-engined dive-bomber in the world. It is a two-seater monoplane.

Perforated wing flaps, which can be seen in the sketch, retard the speed of the dive and steady the plane to improve aiming before the bombs are released. This makes it possible for the plane to have a high speed in level flight.

The plane was originally designed for naval use but it can obviously be a useful land-based dive-bomber. The plane has machine-guns for defensive armament.

In the lower right-hand section of the sketch is another fleet dive-bomber, this time a product of the Curtiss aircraft company.

It is officially known as the Curtiss SBC-4, but almost as soon as it was seen in the air, it was nicknamed "Helldiver"—the name by which it has been regularly known since.

The plane is a two-seater single-bay biplane—that is, it has one inter-plane strut on each side. It is designed for scouting and dive-bombing, operating from aircraft-carriers. The landing gear is completely retractable.

Providing power for the three-bladed controllable-pitch propeller is a Wright Cyclone air-cooled radial engine of 875 horsepower.

A good bomb-load is carried—one half-ton bomb beneath the fuselage and a 100lb. bomb in the rack below each wing. Defensive armament includes a forward firing machine-gun firing through the propeller arc, and a movable machine-gun for the observer in the rear cockpit The design is distinguished by the backward placement of the wings. Wingspan is 34 feet, and length, 27 feet 6 inches. Speed is about 250 mph in level flight.

At the top is the Curtiss Kittyhawk, well known in Australian skies and with a great score of Japanese planes to its credit.

This sharp-nosed machine is one of America's newest standard fighters, an improvement on the Tomahawk, which previously won a good name for itself. It is the fifth style of the Curtiss P40, and is officially the P40E.

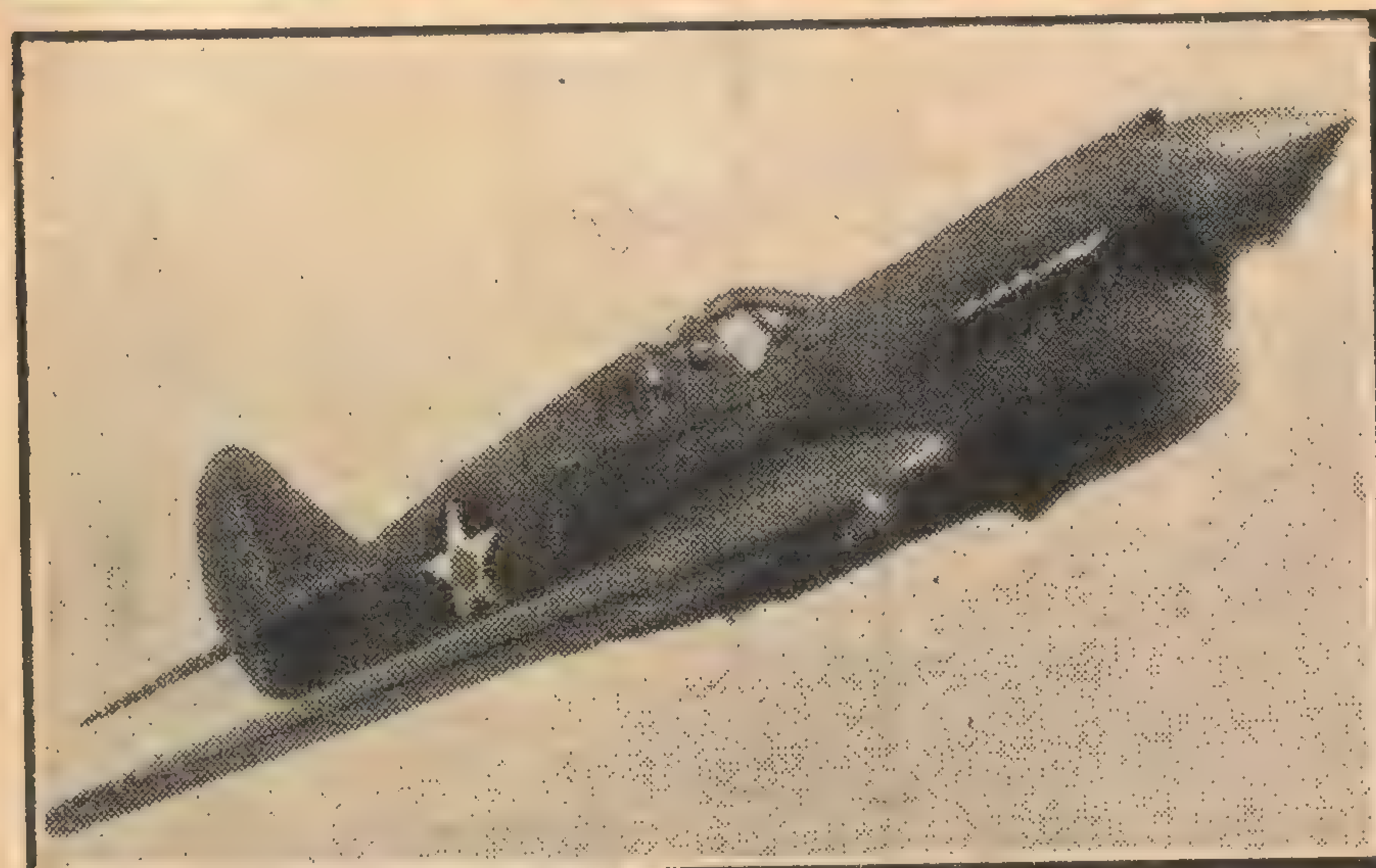
A single-seat pursuit ship, it has great speed—said to be at least 375 mph—and heavy armament. The engine is a 12-cylinder Allison V-type, developing 1320 horsepower.

The Kittyhawk has proved itself in combat to be one of the most efficient pieces of military aircraft in service today.

PORTABLE AERODROME

THE American Air Corps are said to be using portable aerodromes. They are made of steel sheets 10ft. long and perforated with large holes, known as "Marston strip." Hooked together they form a firm landing surface for all kinds of aircraft. During recent manoeuvres one mobile aerodrome was laid in 11 days by an engineer battalion. They can be made to look like orchards or cornfields from the air.

THESE PLANES DEFEND AUSTRALIA—



The Curtis Kittyhawk fighter. Powered by a twelve-cylinder in-line Allison motor, it is capable of a top speed of at least 375 mph. It is of sturdy construction and is well armed. Curtiss Kittyhawks have proved themselves extremely useful as fighter-bombers in the Middle East. Instructions for building a solid model of this plane are given at the end of the article.

A little while ago, with the enemy closing in to the north, Australians were thrilled to hear, in the skies above them, the roar of many modern American fighter planes. The very welcome planes were none other than the famous Bell Airacobra and Curtiss Kittyhawk. Already, they had seen service in other parts of the globe and their usefulness had been demonstrated.

by John French

NOW the Japs are learning to their cost that they are excellent fighting craft and are manned by determined men. The lightness and the manoeuvrability of their famous Zero fighter has its advantages, but the many charred wrecks of enemy planes around our northern coasts bear testimony to the fact that there are advantages on both sides.

Of the two planes, the Kittyhawk has, so far, seen the most service. It was, until recently, the latest fighter aeroplane developed from the Curtiss Hawk P35 and P35A types.

PROTOTYPES

These last-named machines saw considerable service at the outbreak of hostilities, being bought by France and later by Britain in large numbers. Many are still in active service around the globe. Quite a few are rotting on the ground on the French island of Martinique after having been taken from the French aircraft-carrier which put in there when France capitulated.

Early in 1937 the Allison Division of General Motors Corporation, well known in the aero engine field today, and Curtiss got together and produced the XP37, a development of the P35; the main difference was that it had an in-line engine. In 1939 the XP40 was produced and was accepted by the US Army, going into production as the P40B Curtiss Tomahawk in the RAF.

This machine saw considerable service in all theatres of the war, and is still being used in Iceland and in the Middle East, mainly in Libya and Syria. The Tomahawk is now being replaced by the Kittyhawk, a much heavier, faster machine with greater fire power.

However, the Kittyhawk does not represent an entirely stabilised design. Although outwardly unchanged, modifications have nevertheless been made from time to time as occasion or circumstances demanded.

The Curtiss Company is now producing another fighter along the lines of the Kittyhawk, but faster and more deadly. It is known as the Goshawk; details are not yet available for publication.

In appearance, the Kittyhawk is rather similar to the earlier Tomahawk and follows the now conventional formula for fighters, being a low-wing monoplane. It is of all-metal construction, with stressed skin covering and fabric covered control surfaces.

ALLISON MOTOR

Power is supplied by a twelve-cylinder in-line Allison motor, delivering 1325 hp for take-off purposes.

It has a three-bladed Curtiss constant-speed electric-controlled airscrew. It may be a surprise to many to know that the Curtiss Company is a well-known maker and experimenter in air-screws.

The under-carriage is retractable, folding backward. The legs turn through 90 degrees, as they retract backwards and lie flat in the wings. There is also a faring or bulge in the leading edge, which is noticeable. The tail-wheel appears to be fixed in some versions, and retractable in others.

The armament varies somewhat according to the particular theatre of war for which the planes are intended. However, it is reasonable to assume that the armament in all cases is heavier than that fitted to the Tomahawk, which carries six machine-guns.

The Kittyhawk has a span of 37ft. 3½in., an overall length of 31ft. 8½in., and a top speed of about 375 mph.

THE BELL AIRACOBRA

The Bell Airacobra is rather unique in its design. The engine, instead of being mounted in the front of the fuselage, is situated behind the pilot, driving the propeller by means of a long driving rod running between the pilot's legs.

Thus, the main weight component is situated close to the centre of gravity, and this is presumed to add considerably to the manoeuvrability of the plane.

Several squadrons of Airacobras are in service with the RAF, and many are in service with the US Army Air Corps. The planes have also seen action in Russia, where they apparently proved very popular with the pilots.

GENERAL SPECIFICATIONS

The Airacobra is a low wing all-metal cantilever monoplane, with fabric-covered ailerons and flaps, powered with one 12-cylinder Allison liquid-cooled engine of 1090 to 1300 hp. A three-bladed Hamilton Standard constant-speed airscrew is used.

The under-carriage is tricycle and

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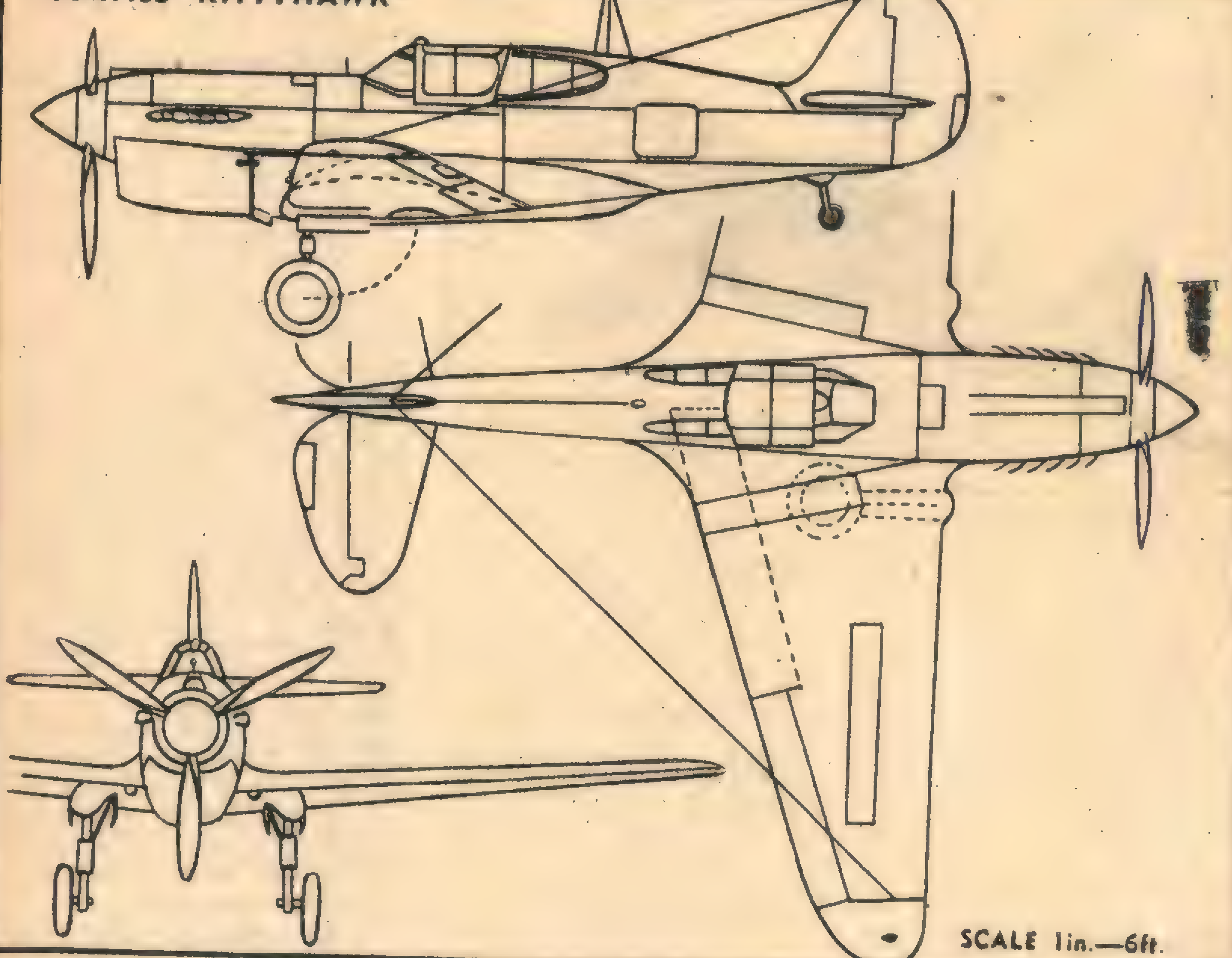
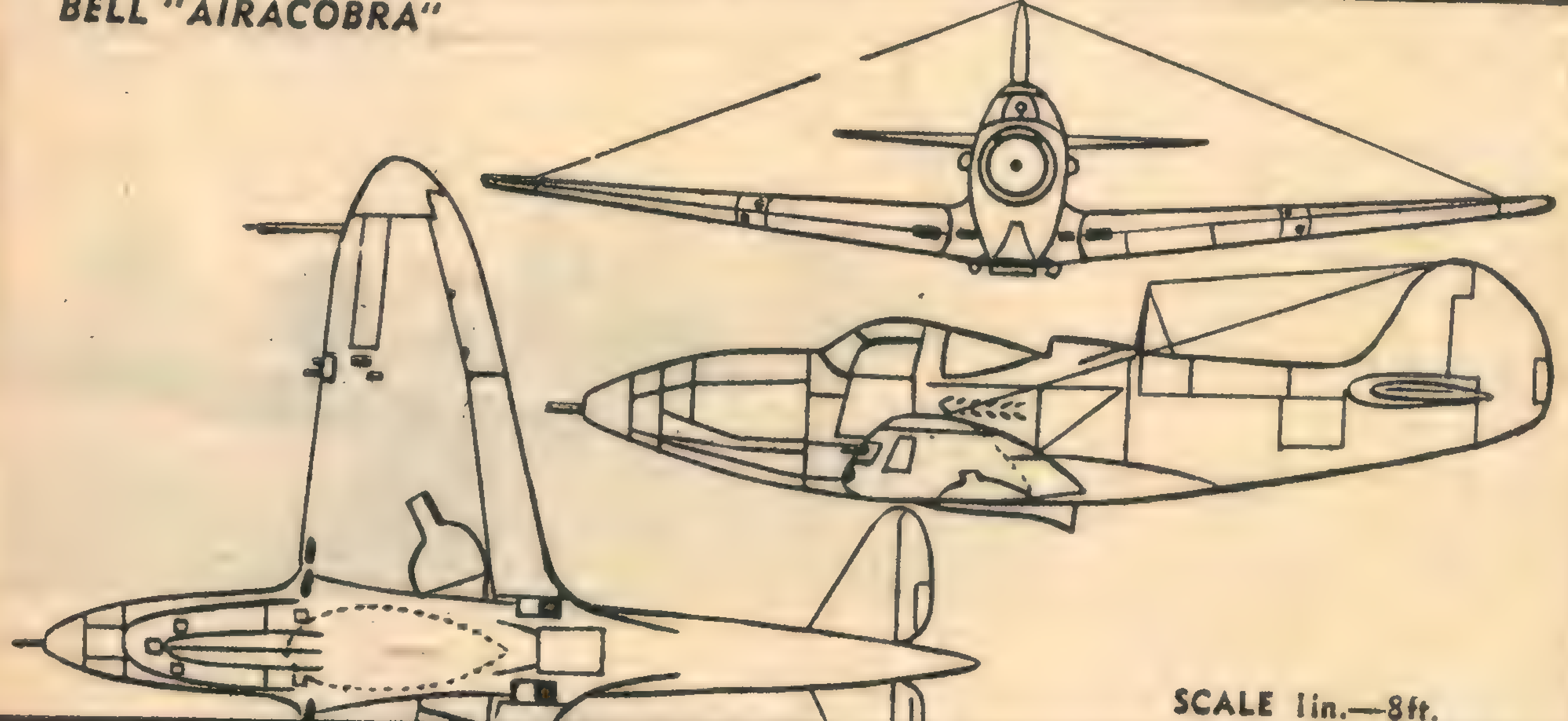
THE "KITTYHAWK" AND THE "AIRACOBRA"

CURTISS "KITTYHAWK"



SCALE 1in.—6ft.

BELL "AIRACOBRA"



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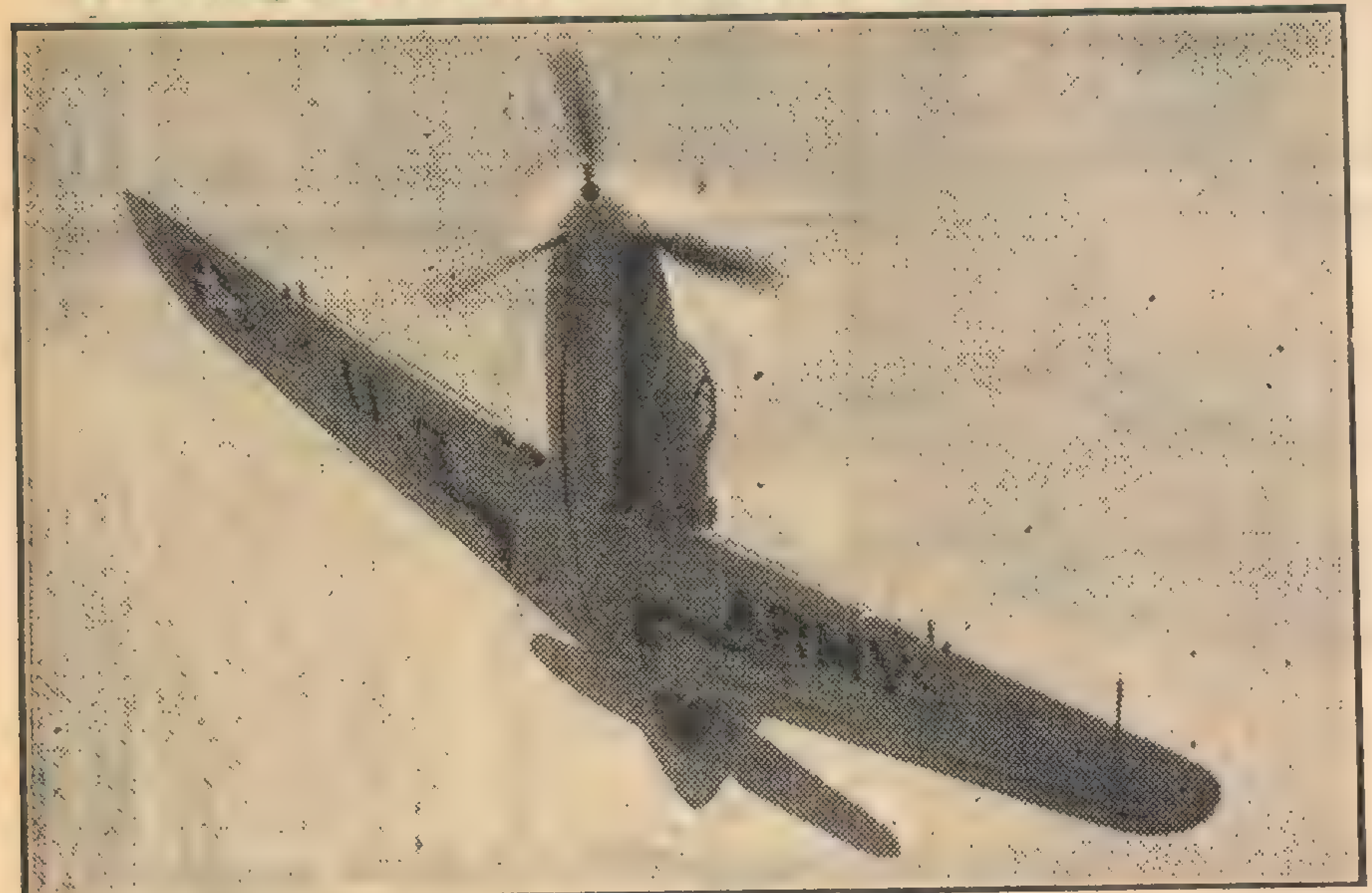
A UNIQUE PLANE—THE BELL AIRACOBRA



The Bell Airacobra in flight. The unusual position of the motor in the centre of the fuselage results in the wings being set somewhat further back than usual. A cannon protrudes through the propeller spinner and there are, in addition, machine guns in the wings. According to reports, the Airacobra has done well against the Luftwaffe in the hands of Russian pilots.

(Continued from Page 12)

fully retractable, although it takes slightly longer than most to retract. As in the case of the Kittyhawk, armament varies somewhat. However, it is no secret that the unusual position of the engine facilitates the mounting in the nose of the plane of a heavy cannon, firing through the propeller spinner.

The Airacobra has a span of 34ft., an overall length of 29ft., and a top speed in the vicinity of 380 mph.

SOLID MODELS

Both the Kittyhawk and Airacobra are in use on practically every front of the war, so a model of each will be quite useful in your collection, because of its aircraft value. If you build good solid models, then take them along to the local Air Training Corps squadron, who will probably be able to use them in the teaching of aircraft recognition.

It is a good idea to scale up the plans of the Airacobra until they are the same size and scale as those of the Kittyhawk. Lack of space made it impossible to give both plans to you on the same scale. If you think that the scaling up is beyond your capabilities, then do not attempt it, because a wrong measurement will throw the model completely out of scale, and thus make it useless for any purpose but ornamental.

For both models you will need a block of balsa for the fuselage, some sheet balsa for wings and tail unit, some pins, some coarse, medium and fine sandpaper, some cement, a filling material such as plastic wood or plasticine, some balsa sealer, and the required colors for finishing the model correctly, a sharp penknife and a razor blade.

Materials such as the block and sheet balsa, sandpaper, cement, balsa sealer, and finishing lacquers may be obtained from your local dealer in model aircraft supplies.

PURPOSE OF MODELS

Both models can be made for one or two purposes, one for display work, the other for straightout recognition. For the first, the cabin could be made separately of celluloid, and all external details such as an undercarriage and the three-bladed propeller could be added.

For the latter, the undercarriage could be retracted, and the three-bladed propeller could be replaced by a round disc of celluloid to represent the propeller on the move; the cabin could just be painted on in silver with black, to make the joins. Such details as the wireless antenna would also be left out.

The reason for leaving out such details is that, if the plane is going to be used for recognition, it will probably be handled by many persons, and the removal of breakable parts is essential. Also, if the machines were seen in flight these details would not be apparent.

The models of the Airacobra and Kittyhawk can be constructed along the same lines. Firstly, trace the side view of the fuselage on the block of balsa, and cut the block out to the outline shape. Next step is to cut the block to the top view shape of the fuselage. Then we have the fuselage in square block form.

CARVING CROSS SECTION

Next carve the correct cross section into the fuselage, and give the fuselage a go over with the coarse sandpaper, finishing up with the fine. The fuselage is now complete. The cabin can either be a part of the block, or made separately by using celluloid.

The wings of either model can be made in one piece. This is by far the easier method, although some may prefer to make the wing in two separate pieces, joining them to the outside of the fuselage. If the wing is made in one piece a slot to accommodate it is cut in the fuselage. When the outline shape of the wing is cut out, the airafoil shape is carved into it, and it is finished off with medium and fine sandpaper.

Details such as undercarriage leg "bumps," and fillets are added later. Cement the wing into position in the fuselage, and leave to dry. Check up on the alignment of wing and fuselage before setting to one side. Dihedral is put in by making a neat cut in the centre of the one-piece wing to about half its depth and then breaking carefully to the correct dihedral.

THE TAIL PLANE

In the case of both models the tail plane and elevators may be made in one piece also, and slotted into the fuselage. Trace its outline shape on to the sheet balsa, and cut to shape. Next carve in the correct airfoil shape, which is an equal curve top and bottom of the centre line. Sandpaper carefully and cement in position.

Check the alignment of the wing and tailplane. The rudder is made in the

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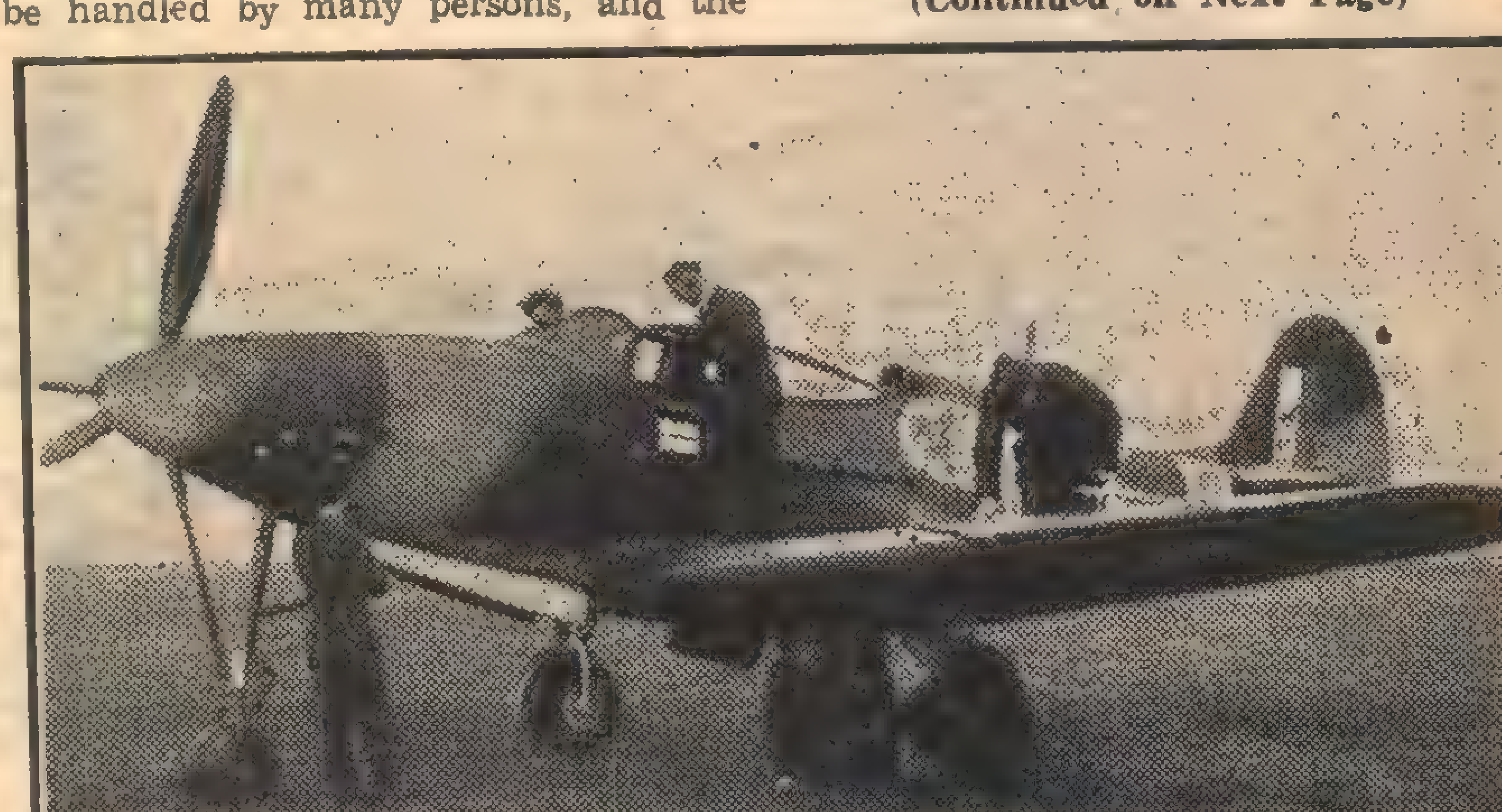
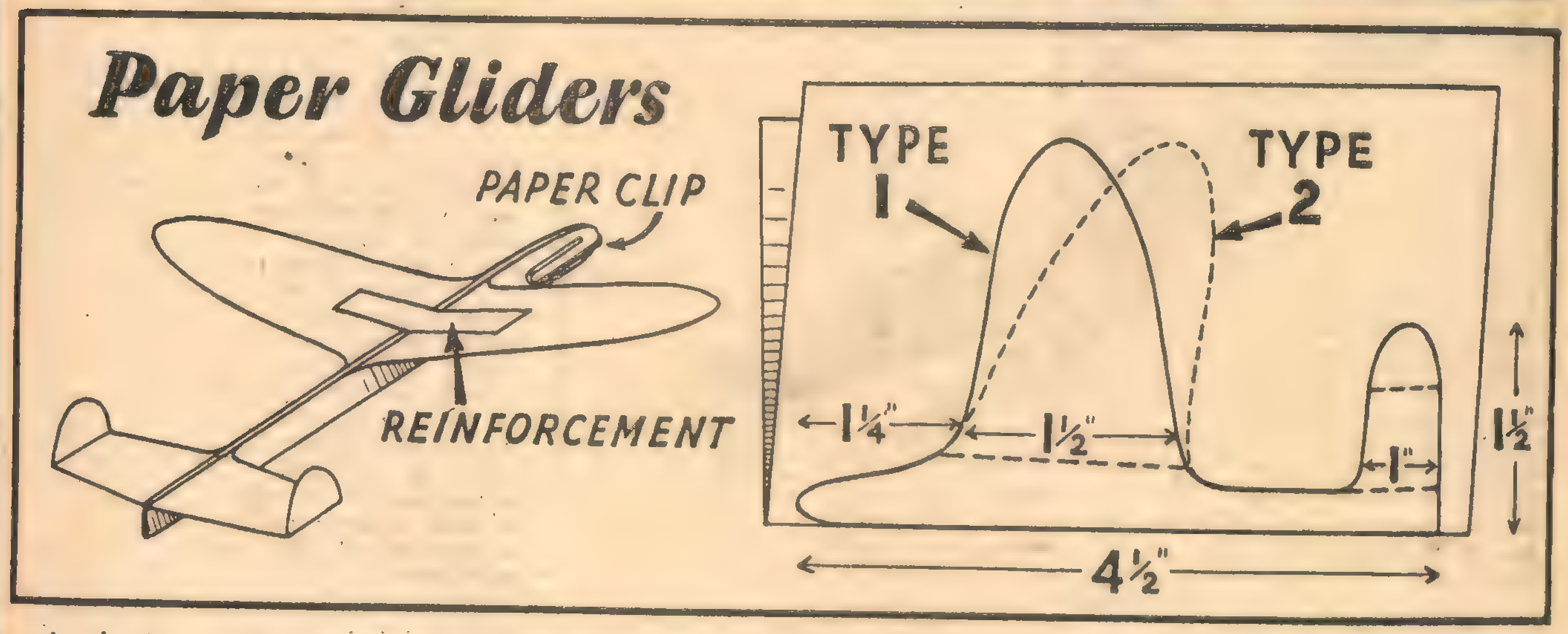


Another view of the Airacobra, this time on the ground and bearing the colors of the RAF. The plane is by no means a large one, as can be judged by comparison with the ground staff who are working on it. Note the three-bladed propeller, the tricycle undercarriage and the long, tapering nose.

ANOTHER DESIGN FOR A PAPER GLIDER



In the May, 1942, issue of "Radio and Hobbies," we featured an article on paper gliders. This article, apparently, proved very popular with our younger readers, who could play for hours without using up more than a few pieces of paper. Here is a little more on the subject.

THE art of making and flying paper gliders seems to be catching on in many places, principally because they are easy to make and inexpensive to build. New ideas that the average model designer or the actual flier may have can be tried out with little fear of damage due to crashing, which is prevalent among the larger all-balsa jobs.

Great fun can be had indoors with these "build-'em-in-a-minute" gliders, especially when wet weather makes outdoor flying impossible. Launched through a window or from the roof of some tall building, these little jobs show their soaring capabilities and very often rise out of sight on the unseen currents of air.

SERVE REAL PURPOSE

Seriously speaking, apart from the amusement side of things, these paper gliders do teach the fundamentals of correct adjustment. In fact, in Younger and Ward's book, "Aeroplane Construction and Repair," a section is devoted to the building and flying of model planes with the object of studying—and here I quote—"the principal features of flight and stability by the use of flying models." As you may have guessed, they ask the student to build various paper gliders.

After you have built the designs which I have put forward, design your own, launch them, and, if they don't fly, try to work out for yourself the reason why they fail.

By this means you will amass knowledge which will stand you in good stead and save you a lot of money when you start building the larger wooden types.

Accompanying the article is another sketch showing two types which follow the same general outlines. The only difference is in the wings; one is shown with all the taper on the trailing edge, the other (shown by dotted lines) with all the taper on the leading edge.

Obtain a piece of stiff writing-paper or typewriter-paper. If you build the model from the measurements shown on the sketch, this paper will be quite suitable. If, however, you are desirous of building a larger one, obtain some thin cardboard of the type used in the manual lectures given in schools.

Bend it in the centre, make a sketch of the outline, and with a pair of scissors hew out the "contraption" as shown in the accompanying sketch. Bend the wings down along dotted line. You will notice there is a slight positive angle on the sketch. Fold down the stabiliser as shown at a slight negative incidence angle, then bend up the tips to form double rudders.

Balance the model in the nose by using glue, rubber cement, a paper clip, or anything that is handy. Check the alignment of the wings and tail and the model is ready for its first test flip. Unless made of fairly thick paper, do not throw the glider too hard or the wings will fold up. If you find this is the usual tendency of the model, add a crosspiece of paper to the centre of the wing span, glueing it into place. Be sure to keep the rudders lined up.

THINGS TO TRY

Paper gliders serve a practical purpose. In a few minutes it is possible to find out the relative efficiency of various aerodynamic set-ups. For example, a little trimming with the scissors will convert the ellipse into a straight taper, or you can find out just how much tail area is needed.

See what a difference in flight performance results when camber is bent into the wings—or when a change is made in wing setting—or the stabiliser angle—or—— Some fun, hey?

THE "KITTYHAWK" AND THE "AIRACOBRA"

(Continued from Previous Page)

same fashion and cemented in place, fitting snugly over the tailplane and on to the end of the fuselage. Careful filling and filleting will make the joints invisible.

Before adding the external details, such as the propeller, undercarriage, radio mast, &c., go over the machine with two to three coats of banana oil or balsa sealer, sandpapering between each coat.

Finally, add the details if you are going to, and the model is ready for painting in the correct colors.

The upper surfaces of the wings and fuselage should be painted in camouflage fashion, using dark slate-grey and a very dark grey-green. Under surfaces should be light grey, with the propeller spinner a duck-egg blue. For British planes, the usual roundals are carried, with the rectangle of colors on the tail fin.

If care is taken two very excellent models should roll off your production line ready for use.

ITEMS OF NEWS FROM A WORLD AT WAR

World's Largest Battleship

THE world's largest battleship—the 45,000-ton USS Iowa—has been launched seven months ahead of schedule.

The US Navy will not give details of this great warship, but "Jane's Fighting Ships" for 1942 says that the Iowa class will carry nine 16-inch guns and 20 of 5-inch.

She will be more strongly armored than the 16-inch belts of the North Carolina class (35,000 tons), and her speed is unofficially reported to be 35 knots an hour.

To fight off air attack, she will carry 16 1.1 inch guns in quadruple mounts of four, plus 50 heavy machine-guns.

* * *

Miles Master III.

A WOODEN two-seater aeroplane which is comparable in most respects to present-day fighters, has been designed by Mr. F. G. Miles. Although not as fast as the most modern fighters, it is claimed to be the fastest wooden machine ever built. Known as the Miles Master III., it is being used as an advanced trainer for which a high degree of safety is demanded. Wood was used to reduce competition with urgent Service needs for metal. A portion of the hooding, however, between the cockpits is specially constructed of metal to form protection for the crew should the plane turn over on the ground.

BRITAIN'S WARSHIP LOSSES

BRITAIN has lost 415 warships of all types since war begun, though a great number are very small ships.

They include three battleships—Royal Oak, Prince of Wales and Barham; and two battle-cruisers—Hood and Repulse.

Five aircraft-carriers went down—Courageous, Glorious, Ark Royal, Hermes and Eagle.

Others lost were 22 cruisers, 83 destroyers, 38 submarines, 11 corvettes, 152 trawlers and drifters, one monitor, one gunboat, 20 minesweepers, two minelayers, 10 sloops, two armed boarding-vessels, 25 miscellaneous auxiliaries, 11 yachts, seven transports, three hospital ships, 14 merchant-cruisers, and three patrol boats.

Loss of these 415 ships has not impaired the Navy's efficiency, because feverish building night and day has kept its strength at a point where it is still the most deadly and formidable sea force in the world.

Bamboo Sea-Dromes

THE Japanese are using floating islands in the Pacific, possibly made from bamboo and large enough for planes to land on, according to Chinese military sources.

Chinese intelligence officers are said to have photographed these islands, which are used as refuelling and rest-stations for pilots and planes.

THE HUGE WIND-TUNNEL AT WRIGHT FIELD

A view of the huge wind-tunnel at the Midwestern US Wright Field. Day and night, man-made tornados roar around the circuit as scientists and pilots co-operate to get the last ounce of performance from the nation's warplanes. Readers may recall the feature article in the August issue dealing with US aircraft research.

Australia's Plane Production

"AUSTRALIA is now producing more planes each month than were turned out by most of the large aircraft organisations in Great Britain and America before the war," according to the Minister for Aircraft Production, Senator Cameron.

"We have reached the point where we have embarked on quantity production of torpedo bombers which challenge comparison with similar aircraft produced in the world's greatest centres of population and industry."

Already large numbers of Beauforts are being delivered to the Air Force, and the trickle of a few months ago is becoming a flood, he said.

"Australia has a population of only 7,000,000, and is hampered by acute shortage of machine tools and basic materials, as well as by great transport difficulties in bringing them from overseas."

Nevertheless, the work is being carried out by more than 300 engineering firms, several railway workshops, and Government annexes, widely dispersed for safety purposes throughout certain States of the Commonwealth.

* * *

Record Power Dive

AN American Baltimore twin-engined bomber has set up a new world's record power dive for bombers in US by reaching a speed of nearly 600 mph. A dive from 23,000 feet showed 400 mph on the air speed meter at 17,000 feet, and nearly 600 mph just before the pilot flattened out.

The Baltimore is an improved version of the famous Martin Maryland, which has done such fine service in the Libyan campaign. A midwing high cantilever monoplane, it is known in the US as the Martin 187, and is claimed to be the fastest and longest-range medium-type bomber. Apart from being fitted with American-built power gun turrets, some of its defence and offensive armament is considered to be unorthodox.

* * *

Radio Licences

THE latest return of broadcast listeners' licences released by the Postmaster-General's Department shows that South Australia has 22.51 licensed radio receivers to 100 people.

Western Australia is next with 19.73, Tasmania has 19.56, and Victoria 19.14.

New South Wales has a percentage of only 17.94.

The total number of licensed sets throughout the Commonwealth at July 31 last was 1,330,619, an increase of 10,546.

Half the increase resulted from the provisions which operated from July 1, which compelled operators of more than one radio receiver to obtain a supplementary licence.

It's Coming To This !

AN Australian Army car is bound out of town on a 50-mile trip, with an AWAS at the wheel and a brigadier in the rear seat.

AWAS: "Would you mind, sir, if I pulled into the kerb and spoke to that Australian officer?"

Brigadier: "Certainly not."

AWAS jumps out, salutes captain standing on footpath, says: "Your wife will not be home tonight, sir."

AWAS salutes and drives off.

One hundred yards further on, AWAS to brigadier: "My husband, sir."

* * *

Shatterproof Glass

TWO members of the Capetown University Staff have stated that they have discovered an inexpensive method of making ordinary window glass withstand the explosion of a 500lb. bomb 70 feet away.

Even if the glass was shattered, the danger of splinters flying was greatly reduced, they said.

The men who made the discovery—George Stewart, a lecturer on civil engineering, and F. Walker, a professor of geology—experimented secretly with Government co-operation. They said the process would be made available to the United Nations.

* * *

Giant Wooden Planes

THE giant cargo planes which shipbuilding wizard, Henry Kaiser, plans to build in his West Coast shipyards may be constructed from wood, according to Kaiser's partner, the millionaire air designer, Howard Hughes.

Says Hughes: "Most designers will probably throw up their hands at the thought of using wood in large planes, but I'm convinced it's practicable."

The final decision regarding the material has not yet been made. Kaiser has an initial order for 100 70-tonners.

* * *

New German Aero Engine

ACCORDING to the official German News Agency, the German Press recently announced that a new secret aeroplane engine is already in production in Germany. It is, they say, one of the largest engines ever mass-produced, and is provided with two banks of cylinders in line. A two-engined dive-bomber of the latest type will be equipped with these engines. The fuel consumption is said to be lower than hitherto deemed possible. Light in weight, this engine is described as being capable of a great performance and suitable for any plane.

* * *

Meat For Britain

THE Federal Government has approved construction of three new plants for the dehydration of mutton.

Expenditure approved will be £200,000 according to a statement by the Commerce Minister (Mr. Scully).

Mr. Scully went on to say that if the work on dehydrating mutton was successful, Britain's present order for 100 tons a month would probably be increased.

SUBMARINES TO ATTACK AXIS SHIPPING

The Sawfish, another new submarine for the US Navy, hits the water on the East Coast after having been built in record time. The undersea fighter was launched 154 days after work began—19 days under the previous record time. US shipyards are launching submarines at a rate approaching one a day.

HAWKER TYPHOON READY FOR ACTION

THE Hawker Typhoon is now being delivered to fighter stations, which means that the fastest plane in the world will shortly be in action. Powered by a 2400 hp Sabre engine designed by Major Frank Halford, it has a speed of over 400 mph. The designer of the Typhoon, Mr. Sydney Camm, said recently: "The Typhoon represents a great advance in aeroplane design, though its great-grandfather was the old Schneider Trophy plane. I have no doubt it will make circles round any machine the Germans have. No other country has yet produced a motor that will compare with the Sabre engine." The first man to fly the Typhoon, Flight-Lieutenant Lucas, Hawkers chief test pilot, said: "It climbs like a rocket, turns easily, and responds immediately to the slightest touch of the controls. Any pilot, though he has only just left his flying training school, could easily fly it.

Transmitters Seized

POLICE have seized four clandestine radio transmitters, one at least operating in an area near the site of recent sinkings of Brazilian ships by Axis submarines.

The newspaper, "O Globo," states that the police also arrested in Aracaju Sergipe an Italian, Nicolas Madavino, found in possession of one of the sets.

An angry crowd attempted to lynch Madavino.

Bread And Margarine

VITAMISED margarine is to be issued to Australian troops in areas where it is impossible to store butter, or where it cannot be satisfactorily handled or transported.

This decision has been made recently by War Cabinet.

According to the Prime Minister (Mr. Curtin), vitamised margarine would be included in the reserve ration for troops.

Reports to War Cabinet by Colonel N. H. Fairley, Army consultant physician, showed that there was no medical objection to the use of vitamised margarine.

* * *

New Cruiser For Australia

THE British Prime Minister, Mr. Churchill, has announced that the cruiser Shropshire is to be given to Australia to help compensate Australia's naval losses in the war to date.

Completed in 1929, the Shropshire has eight 9in. guns.

Secondary armament consists of eight 4in. anti-aircraft guns, four 3-pounders, 14 guns of smaller calibre, eight 21in. torpedo tubes.

The cruiser carries one catapulted aircraft.

The Shropshire is 633ft. in length, her beam is 66ft. and she has a complement of 650

The Prime Minister, Mr. Curtin, subsequently announced that the cruiser was to be renamed Canberra, upon transfer to the RAN.

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As you know, the needs of the men in uniform must come first.

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In the meantime we invite you to take a peep at some of the highly intricate processes involved in the production of "University" meters at the Radio Equipment Laboratories.

An illustrated brochure describing "University" test equipment is available free upon request.

1. "University" meters undergo extremely careful checking and tests before final insertion into "University" test equipment. Thousands of "University" meters are used in military equipment, such as transmitters, signal units, phones, etc.

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3. Fitting tiny meter parts is a job only for sensitive fingers. All Radio Equipment employees are specially selected and trained for all phases of meter and test equipment work.

2.

3.

2. Meter coils are tiny, therefore delicate winding equipment plus great skill in handling is essential.

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4. Showing "University" Supertesters undergoing final tests. Every instrument made by Radio Equipment is thoroughly tested and guaranteed.

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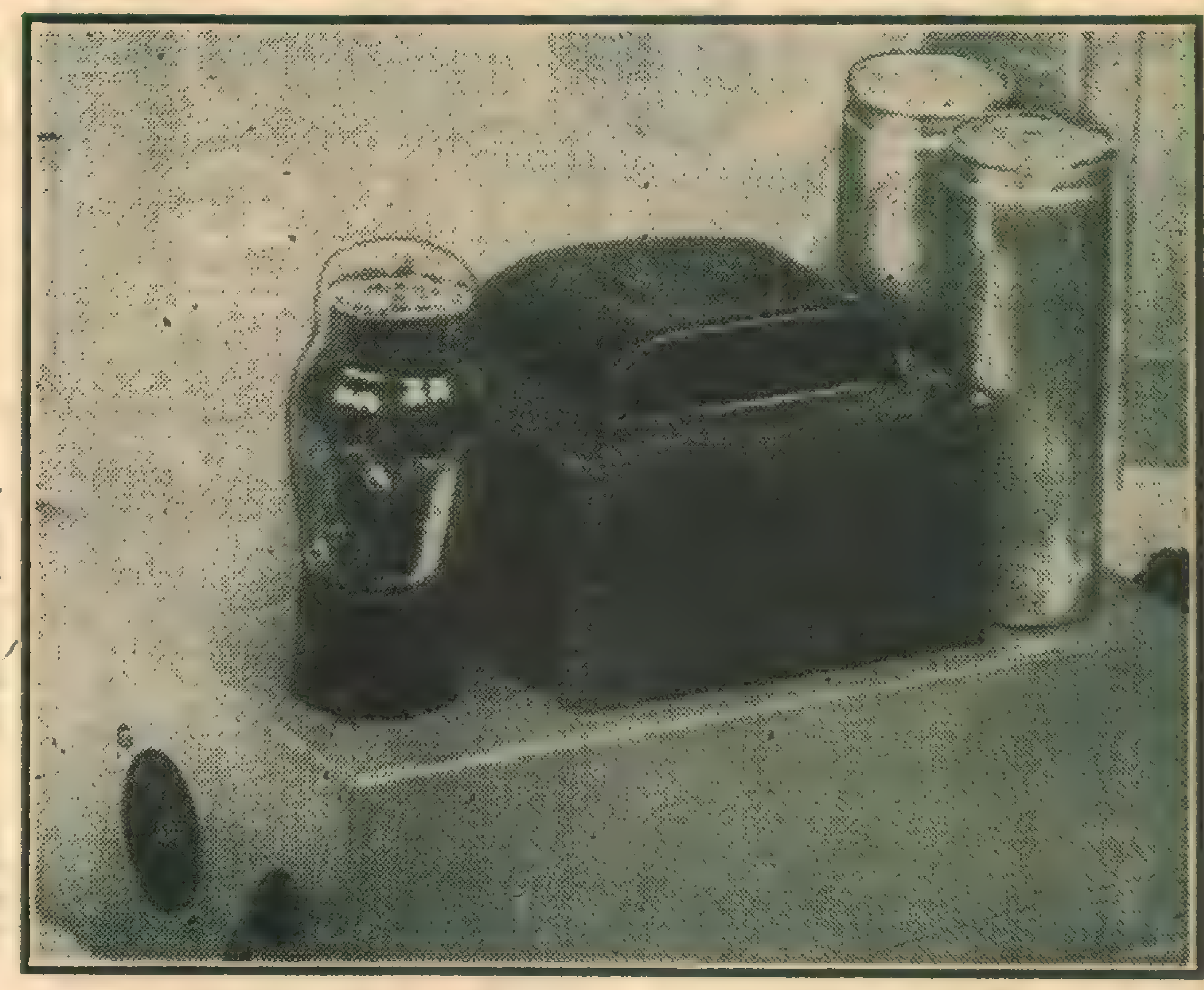
★

THE DESIGN OF A-C POWER SUPPLIES

It is quite some time since we have seen published in any radio journal a complete and self-contained article on the design of a-c power supplies. The subject is a most important one to servicemen and enthusiasts and is not unduly difficult to understand.



SO often, receivers and amplifiers are built up without any really careful consideration of the power supply design. The operating voltage may or may not be accurate, according to the experience and good fortune of the constructor.

Hit-or-miss methods are both undesirable and unnecessary. With the data commonly available, it is possible to design a power supply to deliver a voltage within about five volts of the desired figure.

Strictly speaking, our title covers both heater and high tension supplies. However, we propose to limit the discussion to the latter subject, as the matter of heater supply is more widely understood and does not involve the same difficulties.

Figure 2 shows the essential details of a high tension power supply for operation from a-c power mains. The essential parts of the circuit are a power transformer, a rectifier and a filter system.

TYPICAL CIRCUIT

The usual power transformer has a primary winding, a winding for the heater of the rectifier, a high tension secondary winding, and at least one other low voltage winding to supply the heaters of the other valves.

It will be noted that the high tension winding is shown as being centre-tapped and that the centre-tap forms the negative terminal of the d-c output voltage. The two ends of the secondary are connected to two separate plates within the rectifier valve.

The operation of the rectifier system is not difficult to understand. Before the power is switched on, the cathode of the rectifier is at the same potential as the centre-tap of the high tension secondary winding. Immediately the power is switched on, the plates of the rectifier are swung alternatively positive and negative with respect to centre-tap, according to the voltage and frequency of the a-c high tension supply.

As the plates swing positive with respect to cathode, the valve begins to conduct, and a current flows through the external load circuit. The direction of flow is such that the cathode assumes a potential positive with respect to the centre-tap of the high tension secondary winding.

With 50-cycle power mains and a centre-tapped secondary winding, there are 100 pulses of current per second, since each plate alternatively becomes positive 50 times each second. Excursions of plate voltage in the negative direction do not initiate current flow.

PULSATING D-C

The output of the rectifier system is a pulsating d-c voltage, which is not directly suitable for the high tension supply of a receiver or amplifier. It is the function of the filter system to smooth out the pulsations and to deliver a steady d-c output voltage.

by W. N. Williams

A system having a centre-tapped secondary winding and two rectifier diodes, whether the latter be in the one envelope or otherwise, is known as a full-wave power supply system. Where the high tension is derived from single winding with a single rectifier diode it is referred to as a half-wave system

A rectifier valve incorporating two separate plates is commonly referred to as a full-wave rectifier. One having but a single plate is referred to as a half-wave rectifier.

A full-wave rectifier may be used as a half-wave rectifier by connecting the two plates in parallel and feeding them from a single untapped high tension winding. Two separate half-wave rectifiers may be used in a full-wave system.

All ordinary receivers and amplifiers use full-wave rectifier systems. Compared to half-wave systems, they have the advantage that the ripple frequency is 100 c/s instead of 50 c/s. This higher ripple frequency simplifies considerably the matter of filtering.

For the time being, it is reasonable to pass over half-wave and multi-phase rectifier systems and concentrate attention on ordinary full-wave systems which are of more immediate interest to the majority of readers.

SECONDARY VOLTAGE

Most power transformers these days are wound with a high tension secondary winding rated to deliver 385 volts each side of the centre-tap. This particular figure has become more or less standardised and, indeed, some sort of standardisation is very welcome to manufacturers, distributors and servicemen alike.

Thus it is that the majority of receivers described in these pages are designed to use a power transformer having this secondary voltage rating. Sometimes the voltage is not exactly the most convenient, but the difficulty can usually be overcome by a certain amount of manipulation of the circuit and circuit constants.

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BASIC CIRCUIT OF A-C POWER SUPPLY

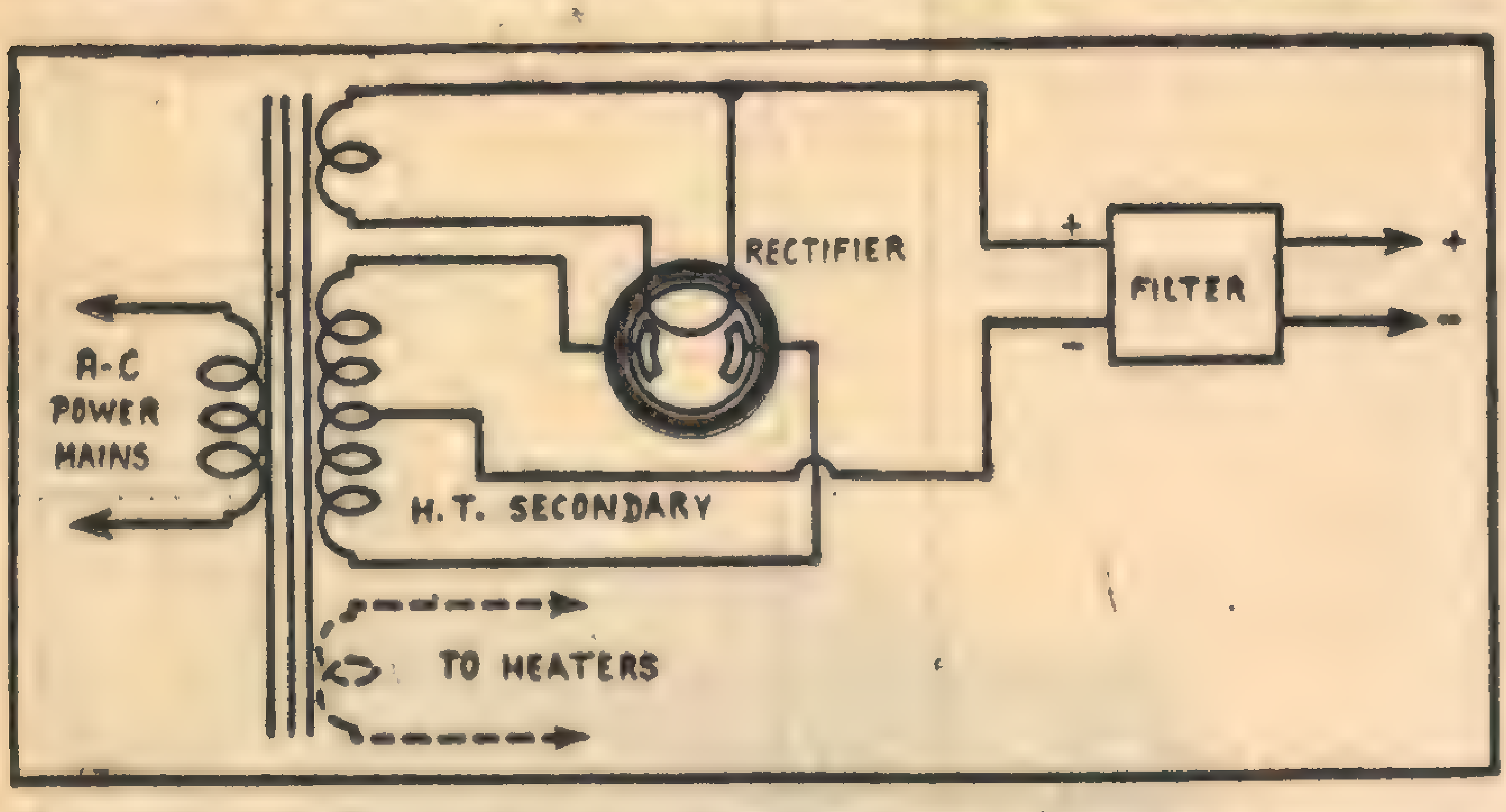


Figure 2. The essential details of a typical a-c power supply. The power transformer has one winding to supply the filament of the rectifier, a centre-tapped high tension secondary winding and at least one other winding to supply the heaters of other valves in the apparatus. Then there is the rectifier valve itself and finally the filter system.

In very small receivers and amplifiers, a 385-volt secondary winding is often unnecessarily high, and considerable simplification can be effected by using a transformer with a lower secondary voltage. This accounts for the non-standard transformers used in many small receivers.

VOLTAGE TOO LOW

Conversely, in very large receivers and amplifiers, a 385-volt winding may be inadequate, and it may be more or less essential to use a transformer delivering a much greater secondary voltage. There are other special circumstances which render standard transformers unsuitable for certain apparatus.

As far as we are concerned, we endeavor to use standard 385-volt transformers where at all possible. If a particular circuit has a non-standard transformer, it can usually be assumed that the use of a standard transformer is rather out of the question.

The substitution of a higher or lower voltage transformer in an accepted design is undesirable. A difference of up to 15 volts can usually be ignored, but above that the substitution should not be made without readjustment of the circuit to accommodate the new input voltage.

CURRENT RATINGS

Apart from the voltage rating, power transformers are usually rated in terms of so many milliamps. Strictly speaking, a transformer secondary should be rated in terms of watts, since dissipation and heating cannot really be expressed purely in terms of the d-c output current.

The milliamp ratings are based on the assumption of a condenser input filter and serve as a good general guide as long as this assumption is recognised. For reasons which will be more apparent later, with a choke input filter the d-c output current may be somewhat higher than the current with condenser input for equivalent heating in the secondary.

The regulation of the secondary winding of a power transformer is fairly good and the output voltage does not vary unduly with changes in load current. For this reason a power transformer may always be substituted for another power transformer having a lighter current rating but the same voltage rating.

Thus, in a circuit requiring a 60 milliamp transformer, it would be quite in order to use one of 80, 100 or 125 milliamps, provided that the secondary voltage was as specified. There would be only a very slight rise in the d-c output voltage.

RECTIFIER RATINGS

The manner of rating rectifier valves was altered some two or three years ago, and ratings are now in terms of peak inverse voltage and peak plate current per plate. The exact interpretation of these ratings is rather difficult, since it involves the knowledge of such things as the plate supply impedance, the exact d-c output current, and the precise characteristics of the filter system.

As a general guide, typical maximum operating conditions are usually listed in addition, although these are not to be considered as the actual maximum ratings. For example, it might be possible to exceed the maximum voltage input shown under a typical operating condition, provided that the current was kept below the corresponding current rating.

However, unless you are in a position to check such points, it is well to keep within the quoted input and output voltage and current ratings.

It should be noted that the ratings differ considerably for choke and condenser input filters.

In addition to voltage and current ratings, a rectifier valve has another important characteristic, namely, its internal impedance. This last characteristic has a direct effect upon the output voltage which different rectifier types will deliver under given operating conditions.

INTERNAL IMPEDANCE

Directly-heated rectifiers, such as type 80, 5Y3-G, 5Z3, &c., usually have a fairly high internal impedance compared to indirectly-heated types, such as the 83V and the 5V4-G. The direct substitution of one of the latter types for one of the former would normally result in a marked increase in the d-c output voltage.

However, there is an appreciable difference in the impedance of individual directly and indirectly-heated valve types. An example of this would be the 80 and the 5Z3.

The different impedance values can be made use of when designing a power supply and one can change the output voltage by the simple expedient of choosing the most suitable rectifier.

Generally speaking, rectifiers with a fairly high internal impedance are to be preferred, as they are less liable to arc over or be damaged under conditions of accidental overload. On the other hand, low impedance rectifiers give higher output voltage for a given input and give better voltage regulation.

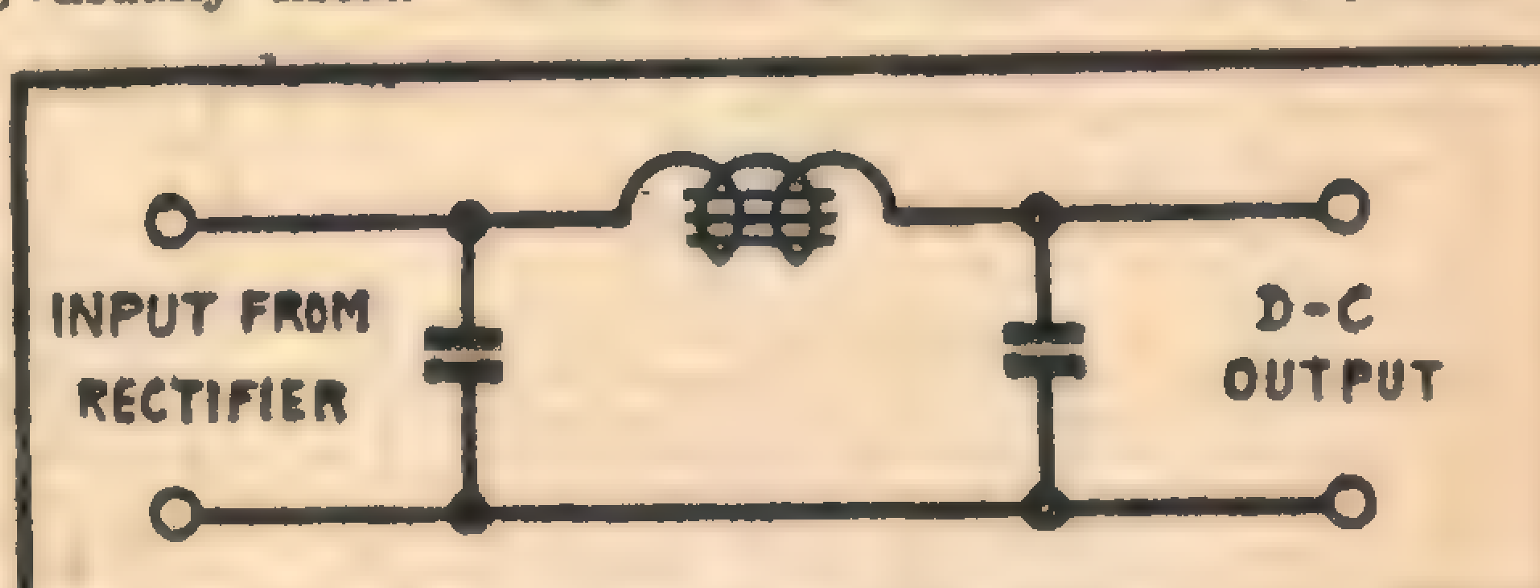
FILTER SYSTEMS

Maximum operating conditions, internal impedance and regulation characteristics are all correlated in operation characteristic curves available for most rectifiers. These curves will be discussed in some detail later in the article.

Broadly speaking, there are two main types of high tension filters, namely, the condenser input filter and the choke input filter.

As the name implies, a condenser input filter is one in which a condenser is connected directly across the input of the filter and therefore directly across the output of the rectifier. A typical condenser input filter is shown in Fig. 3.

Figure 3. A single section, condenser input filter network. This type of filter is used in the majority of small receivers and amplifiers, the speaker field serving as the inductance.



In the case of a choke input filter, there is a choke in circuit between the output of the rectifier system and the first filter condenser. A simple choke input filter system is shown in Fig. 4.

Condenser input filters are most commonly used in ordinary receivers and amplifiers. Compared to choke input filters they have the advantage of delivering higher output voltage for a given input. Broadly speaking, the filtering efficiency is also better.

Against this is the disadvantage of poorer voltage regulation, which means that the output voltage is subject to greater change with variations of load current. Power supply regulation is unimportant in receivers and amplifiers using class A power stages, but is progressively more important in connection with power stages operating under conditions of class AB1, AB2 and class B.

The characteristics of a choke input filter may be summarised as better regulation, lower output voltage and poorer filtering than a corresponding condenser input filter.

LAMINATIONS HUM

In a choke input filter, there is a considerable ripple component across the first filter choke, with the result that there is a marked tendency for the laminations to vibrate. The vibration may set up a very objectionable mechanical hum unless the laminations are tightly clamped in a stout frame. For this reason, the usual run of filter chokes on the market are not entirely suitable for use as the input choke to a choke input filter.

Any filter network involving filter chokes has some d-c resistance, and therefore introduces a d-c voltage drop. This voltage drop has to be allowed for in the design of the power supply.

When low resistance filter chokes are used, the total voltage drop across the filter network may be as low as about 20 volts. On the other hand, when a speaker field is used as a filter choke, the total voltage drop may be well over the 100-volt mark.

The d-c resistance of the filter system has an important bearing on the regulation of the power supply. As we explained earlier, regulation is not a very important matter, except in receivers and amplifiers using class B, class AB2, and sometimes class AB1 power stages.

DESIGN PROCEDURE

So much for the preliminary discussion. Let us now proceed to outline the steps in designing a high tension power supply.

As a rule, one begins with an idea of the number of stages, the valves and the operating conditions in a certain receiver or amplifier to be constructed. One usually aims also to use a standard 385-volt power transformer.

On this basis, the first step is to decide upon the required high tension voltage at the output of the filter and also the total current drain. The next step is to choose a rectifier valve capable of handling the current and, by reference to the appropriate curves, to discover the output voltage of the rectifier under conditions of 385 volts full-wave input, condenser or choke input filter as required, and at the previously calculated current load.

The difference between the output voltage of the rectifier and the required high tension supply voltage represents the permissible d-c voltage drop across the filter system.

Knowing the permissible voltage drop across the filter system, and the current drain, the total d-c of the filter network resistance may be calculated by Ohm's law. Remember that the resistance in ohms is equal to 1000 times the voltage in volts over the current in milliamps.

Figure 4. A single section choke input filter. The efficiency of such a filter is rather poor by comparison and choke input filters are usually of the two-section variety.

If you are fortunate, the figure of d-c resistance so calculated will be approximately equal to the resistance of one of the standard field coils or perhaps the sum of the resistances of a field coil and a choke.

Having discovered the nearest standard field coil, the final step is to check the dissipation in the field to see that it is within reasonable limits.

As is only to be expected, things do not always work out in the most convenient manner, and it may be necessary to do quite a lot of juggling with the circuit constants. For example, it may be found that the d-c resistance of the field coil has to be too high, the dissipation exceeding the permissible limits for the type of speaker to be used.

The use of a rectifier other than the one chosen may result in a lower output voltage, and may therefore require

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TYPICAL TWO-SECTION FILTER

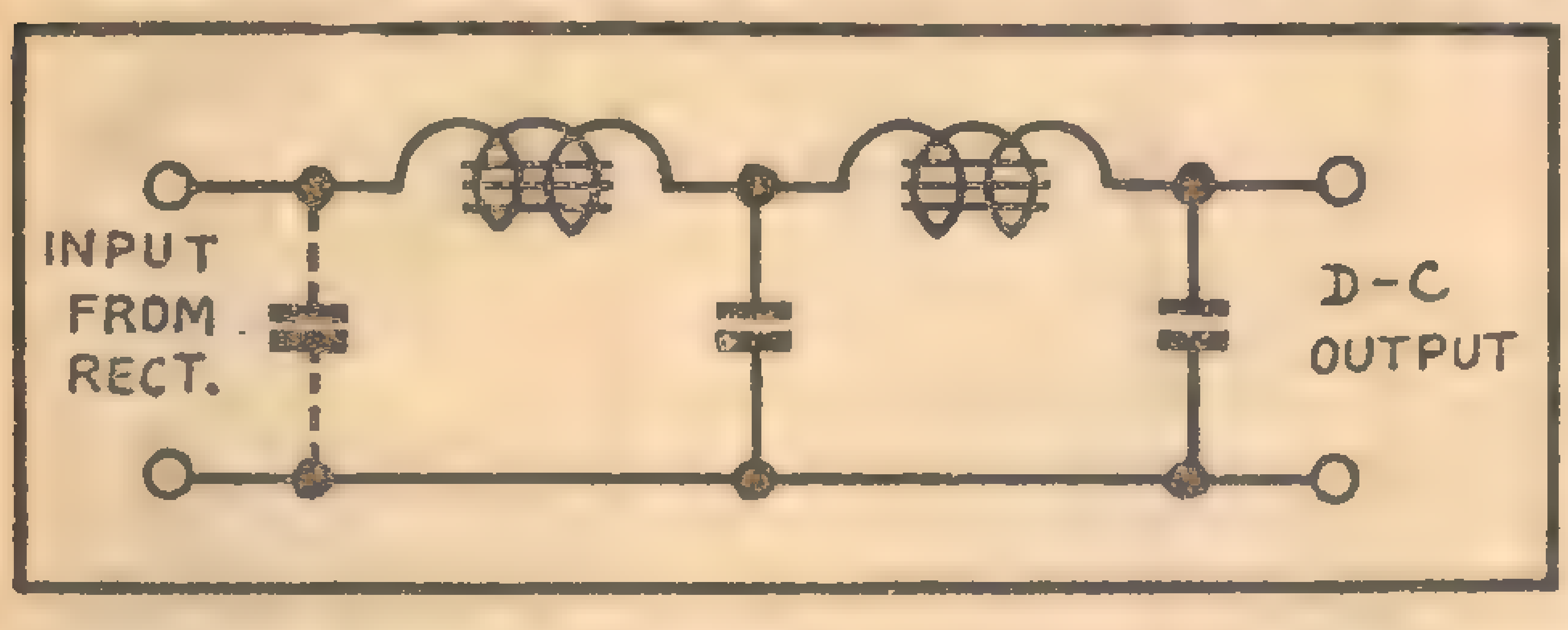

Figure 5. A typical two section filter network as often used in receivers or amplifiers. The inductance at the output end may well be the field coil of a loudspeaker. The inclusion or otherwise of the condenser shown dotted determines whether the network is to be referred to as a choke or condenser input filter.

less voltage drop across the field. Again, it may be possible to choose other operating conditions for the output valves so as to allow a higher plate voltage, thus requiring less voltage drop in the filter.

In some cases it may even be necessary to add a dropping resistor in series with the filter, or even to choose a transformer with a different secondary voltage rating.

In just the same way, if the voltage drop across the filter network is inadequate to properly energise a speaker field, should that be desired, the condition may be rectified by a choice of other components or operating conditions.

ALTERNATIVE APPROACH

In many cases, one begins with certain components on hand, perhaps a transformer, a rectifier, certain valves, and a speaker with a certain value of field coil resistance, and one wishes to use the lot in a receiver or amplifier.

By the use of rectifier curves, and by means of calculations already outlined, it is often possible to devise a suitable set of operating conditions.

Of course, there are plenty of occasions when all the parts on hand simply cannot be worked in to advantage, and it may be necessary to substitute for one or more of the parts. However, far better to work these things out beforehand than to have to go to the trouble of building up the apparatus in the vain hope that it will work.

Though in all this one might be juggling components and values, it is important to note that such things are not done blindly, and when the final operating conditions are chosen, there will be every reason to expect that the result will check up very closely with the theoretical calculations.

RECTIFIER CURVES

Before working out a specific example, it will be necessary to become familiar with rectifier operation characteristic curves, since all calculations are necessarily based . these curves

Rectifier operation curves are reproduced in the majority of valve manuals The rectifier types in which we are particularly interested in Australia are the 5Y3-G and its electrical equivalents, the 80 and the 5Y4-G; the 5U4-G and its electrical equivalents, 5Z3, 5X4-G, and U52; the 5V4-G and its equivalent, the 83V, and finally the 6X5-GT.

Of course, there are plenty of other rectifiers to be met with, but the discussion in regard to the above applies equally well to the lesser known types. Rectifiers for ac-dc receivers and mercury vapor rectifiers will be mentioned later.

Comparison of curves from different sources for the same rectifier valve sometimes discloses slight differences. These differences are accounted for by slight variations in valves of different manufacture, by slight structural changes, and by the fact that some of the curves are perhaps drawn for different circuit conditions.

DIFFERENCES SMALL

For example, some curves from American sources are for 60 cycle power mains, whereas the standard figure for Australian conditions is 50 c/s. Most of these differences are, however, only slight, and can be ignored except where very accurate calculations are involved.

In any case, the maximum error likely to be encountered is about 5 per cent., which is at least as small as the tolerance on most other component values in the circuit.

Perhaps the most up-to-date and complete sets of rectifier curves are those made available by the Amalgamated Wireless Valve Company, in the form of loose leaf valve data sheets.

One of these sheets is reproduced as figure 6. It is actually the curve for the 5Y3-G or 80 rectifier with a condenser input filter.

The panel at the top shows the conditions for which the curves apply. The heater voltage is exactly 5.0 volts. The plate supply impedance, which is largely dependant on the d-c resistance of the transformer primary and secondary winding, is 80 ohms. The supply frequency is 50 c/s, and the filter is of the condenser input variety, having an 8 mfd. input condenser.

Deviations from these set conditions will mean in practice that the d-c output voltage from the rectifier system will vary somewhat from the plotted value. However, the deviations will normally be small, and can be neglected except where extreme accuracy is necessary.

INPUT CONDENSER

The 8 mfd. input condenser is quite a typical value, and will apply in most cases. The use of a larger input condenser would result in slightly higher output voltages under conditions of high current drain; the use of a smaller input condenser would have the opposite effect.

Plotted along the bottom of the graph is the d-c load current in milliamps. The d-c output voltage at the input to the filter is plotted along the side of the graph. The heavy lines traversing the graph represent different values of a-c input voltage to the plates.

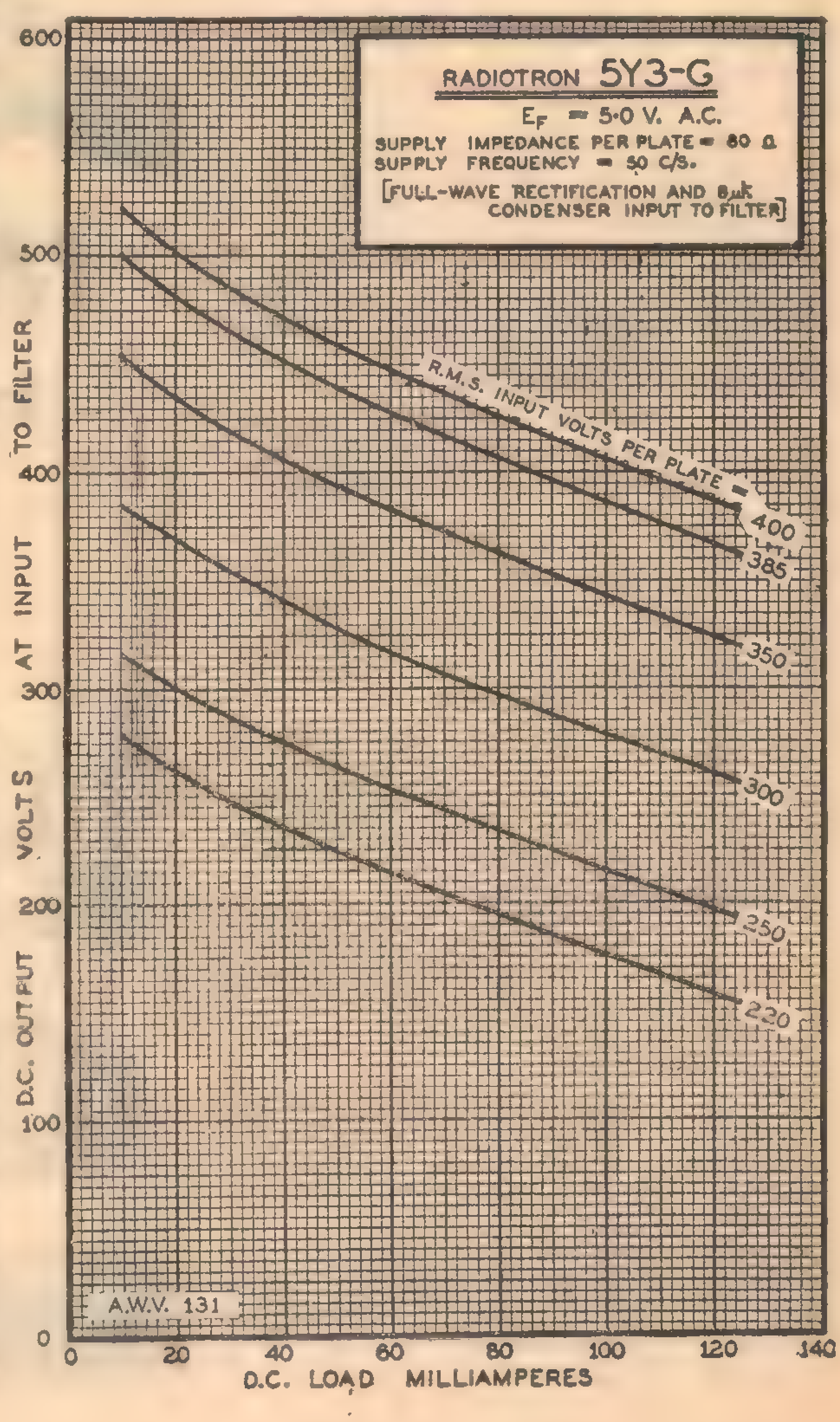

Figure 6. Here are the operation curves of the 5Y3-G and 80 rectifiers, operating in a full-wave circuit and in conjunction with a condenser-input filter. The precise conditions of filament voltage, supply impedance and supply frequency for which the curves were originally drawn are listed in the panel at the top of the graph. As explained in the article, minor variations from these specified conditions do not affect the output voltage to any great extent (Reproduced by courtesy of the Amalgamated Wireless Valve Co. Pty. Ltd.)

To find the d-c output voltage with a certain a-c input, and under certain load conditions, it is necessary to note the point where the particular a-c input line intercepts the particular current line, and trace the value across to the scale representing d-c output voltage.

Thus, with an a-c input voltage of 385 volts and a load current of 40 milliamps, the d-c voltage at the input to the filter would be 455 volts.

HIGH OUTPUT VOLTAGE

Note that, under these conditions, the d-c output voltage is considerably higher than the a-c input. The reason is simply that the input condenser tends to charge to the peak value of the a-c input, which is equal to root 2 times the RMS or nominal value of the a-c input. Root 2 times 385 is equal to nearly 550 volts.

At 80 milliamps drain, and with the same a-c input, the d-c output voltage is 407 volts. At 100 milliamps it falls to 386 volts, and, at the limit of 125 milliamps, it is 362 volts.

With an a-c input per plate of 300 volts, the d-c output voltage falls from 385 volts at 10 milliamps drain to 256 volts at 125 milliamps. Try reading the curves for yourself, so that you become perfectly familiar with the way in which they correlate a-c input and d-c output voltage and current.

VOLTAGE REGULATION

The slope of the transverse lines, representing the decreasing output voltage with increasing load current, indicates the regulation to be expected from the particular valve under the particular operating conditions.

It also shows very clearly why the electrolytic condensers so often sizzle when a receiver or amplifier is first switched on—or why some electrolytics break down altogether.

If the rectifier is one which heats up more rapidly than the other valves in the receiver, and the design of the latter is such that there is little or no initial current drain, the output from the rectifier for a short period is very high, gradually falling to the normal figure as the other valves begin the draw current.

In the particular graph reproduced, both the output current and voltage scales are in considerable detail, but the transverse lines representing a-c input are drawn in definite steps and are fairly widely spaced.

INTERPOLATION

For intermediate values of a-c input, it becomes necessary to interpolate. Thus, the line representing an a-c input of 325 volts would be approximately half-way between the lines for 300 and 350 volts, and so on.

Where interpolation is considered unsatisfactory, reference may be made to the so-called "constant current" curves, reproduced in figure 7. The information given in these curves is exactly the same as that in those of figure 6, except that the values are plotted in a different fashion.

(Continued on Next Page)

In the constant current curves, the d-c output voltage is plotted against the a-c input for various values of load current. It should not be difficult for you to fathom out just how these curves are read.

Constant current curves for rectifiers are less common than the curves shown in figure 6, and it is only on odd rectifier types that they are available.

Figure 8 shows the conventional operation curves for a 5Y3-G or 80, this time in conjunction with a choke input filter As before, the curves are drawn out for certain defined circuit constants, the choke being defined as one having a minimum inductance of 5.0 henries at the particular current drain.

Usually, the inductance of a choke at any particular current drain is not known, and, once again, certain minor factors have to be ignored. However, for all practical purposes, the curves can be treated as accurate for all typical cases.

Comparison of Figures 8 and 6 bear out the previous statements in regard to choke and condenser input filters. It will be noted that the transverse lines for choke input are more nearly level than those for condenser input, indicating that the voltage regulation is better. At the same time, the d-c output for a given input voltage is considerably lower.

Thus, with an a-c input per plate of 400 volts and a d-c current drain of 100 milliamps, the d-c output voltage is near enough to 302 volts. With condenser input, the d-c output under the same conditions is 406 volts.

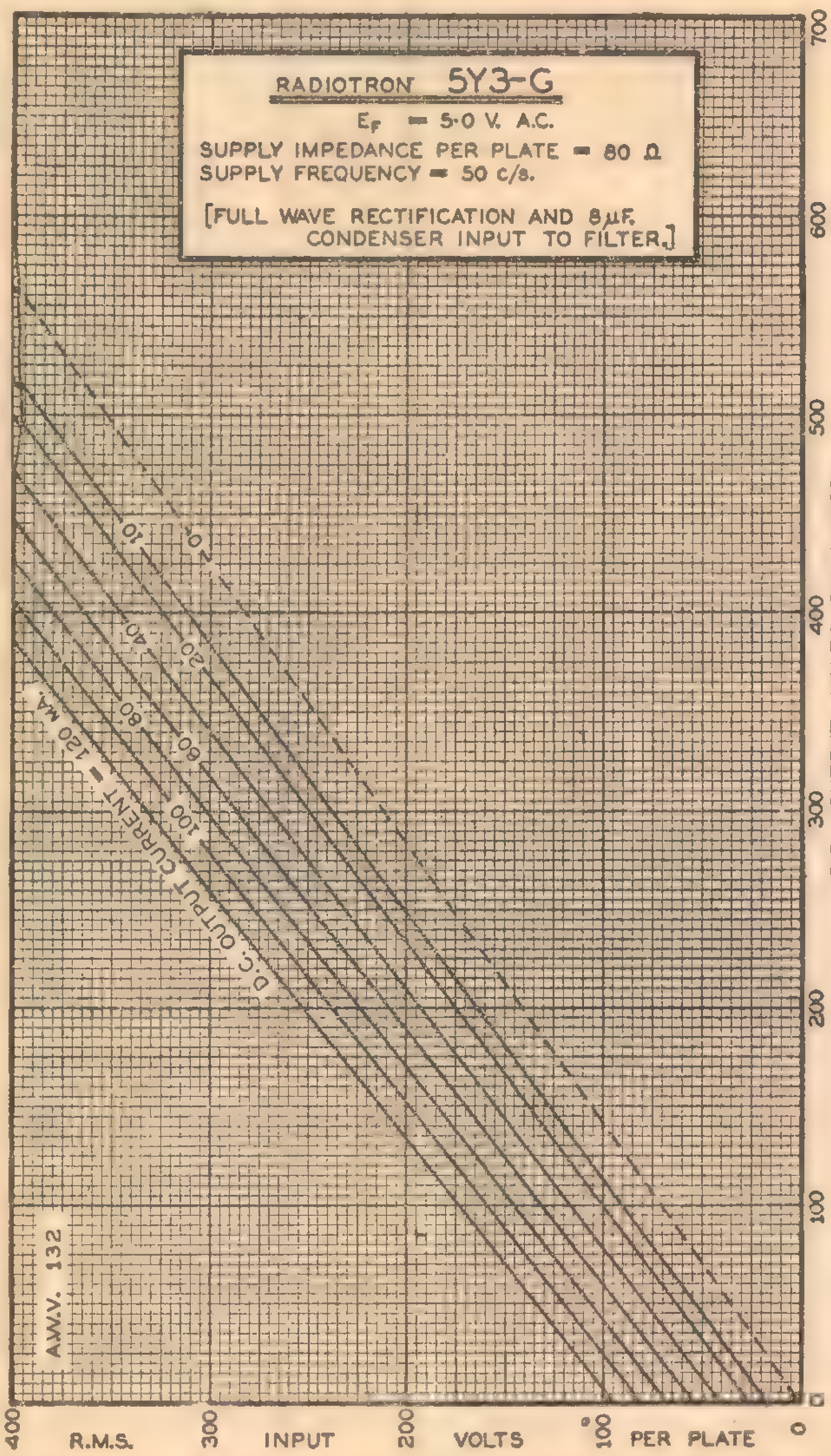

Figure 7. Here are the constant current curves for the 5Y3-G rectifier. The information conveyed is precisely the same as in the curves of figure 6, except that values are plotted in a different manner. Note that output voltage is plotted against input voltage for various values of load current.

INPUT VOLTAGE

At the same time, whereas 400 volt a-c represents about the limit of the a-c input voltage permissible with condenser input, with choke input an a-c voltage of up to 500 volts is permissible.

The constant current curves for the 5Y3-G and choke input filter are also shown in Figure 8. The effect of the better regulation is seen in the manner in which the current lines are squeezed together.

Curves for all other vacuum rectifiers follow the same general lines as those for the 5Y3-G, differing only in detail After a little practice, you should not have much difficulty in reading off various values from any rectifier operation curve.

One point which is worthy of special mention here is the scheme suggested some time ago by the AW Valve Co. of operating the 5V4-G with resistors of 125 ohms in series with each plate lead.

As it stands, the 5V4-G is a vacuum rectifier with unusually low internal impedance. A 5V4-G rectifier will therefore give higher output voltage under stated conditions than almost any other type of vacuum rectifier. However, its low internal impedance makes it rather prone to damage under adverse or overload conditions.

By connecting resistors in series with each plate lead, the apparent internal resistance is increased. The 125 ohm series resistors were chosen to give electrical characteristics very similar to those of the 5Z3 and 5U4-G, which valves have been difficult to obtain since the outbreak of war.

For the 5V4-G, therefore, a set of curves has been made available for this special application, in addition to the curves for conventional condenser and choke input.

At this juncture it may be as well to make passing mention of rectifiers for ac-dc receivers and of mercury vapor rectifiers.

As far as Australian conditions are concerned, the ac-dc rectifiers of particular interest are such types as the 25Z5, the 25Z6-G and the 25Y5.

AC-DC RECEIVERS

In ac-dc receivers no power transformer is used, and the mains voltage is applied directly to the plates. For this reason, there is no point in drawing out curves for input voltages other than those equal to nominal mains voltages. These latter voltages are usually 117 and 235 volts.

A further point is that, owing to the absence of a centre-tapped supply transformer, the valves are not normally used in full wave circuits.

The reason for the inclusion of separate plates and cathodes is to provide for voltage doubling circuits of the type used quite frequently in small American receivers. Voltage doubling has little application under Australian conditions with 240 volt power mains.

In half-wave rectifier systems the capacitance of the input condenser is of increased importance, particularly at heavier values of current drain. Thus, for these particular valves, it is usual to draw a number of curves representing the d-c output voltage with different values of input condenser.

OPERATION CURVES

To sum up, examination of the operation curves for rectifiers commonly used in ac-dc receivers usually reveals transverse lines representing the d-c output voltage with two values of input voltage and with up to three values of input condenser. Choke input conditions are rarely mentioned

In addition, there may be curves for operation as a voltage doubler. The various curves are usually identified by using a system of solid, broken or dotted lines. Of course, there are plenty of rectifier types which are not suitable for operation on 240 volts or for use as voltage doublers.

We do not intend to make further reference to rectifiers for ac-dc receivers, but the foregoing remarks have been made with the idea of explaining the distinctive method of drawing the operation curves.

MERC. VAPOR RECTIFIERS

For mercury vapor rectifiers, curves are not normally given. These rectifiers now have little application in receivers or small amplifiers. The only types which have been used extensively in the past for these applications are the 82 and 83.

Both these types were intended primarily for operation into a choke input filter, so that the condenser input filter application can largely be neglected.

Owing to the presence in the envelope of mercury vapor, the voltage drop across the rectifier, once the vapor has ionised, is approximately 15 volts, irrespective of the d-c current drain.

The d-c output from a full wave mercury vapor rectifier system is approximately equal to the average value of the a-c input voltage minus 15 volts, representing the drop across the rectifier. The average value of the a-c input voltage is equal to 0.9 of the RMS or marked value of the a-c input voltage.

Thus, with an a-c input voltage of 385 volts, the d-c output voltage would be 385 x 0.9 equals 15 equals 331 approximately volts. This output would remain practically constant irrespective of current, within the ratings of the transformer and rectifier.

EXCELLENT REGULATION

The excellent regulation of mercury vapor rectifier systems make them particularly attractive for class B amplifiers, but the gradual displacing of this type of amplification for receivers and small amplifiers has largely meant the displacing of mercury vapor rectifiers.

Apart from this, mercury vapor rectifiers tended to introduce quite a lot of electrical hash and were not always as reliable as they might have been.

Having now gained a general idea of the various factors involved and having become more or less familiar with rectifier operation curves, we can now proceed, by way of example, to work out the design for the power supply of a typical receiver.

To make things easy to follow, let us consider a five-valve superhet receiver along the lines of the receiver described elsewhere in this issue. We can bear in mind that, in a receiver of this nature, there is a fair amount of tolerance as far as the supply voltage is concerned.

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TYPICAL DESIGN

As explained previously, the first step in designing the power supply is to decide upon the operating conditions of the valves and then to total up the current drain of the receiver under the particular operating conditions.

For a receiver of this nature, we will probably not desire to push the valves to the limits of their ratings, so that the ordinary 250 volt operating conditions can be regarded as satisfactory.

First of all, the 6F6-G output valve will require a supply voltage of 250 volts plus 16.5 for the bias, making a total supply voltage of 266.5 volts. We can regard this as the approximate d-c voltage required at the output of the filter. We say approximate, because a variation of a few volts either way would not affect the performance to any great extent.

Under no-signal conditions, the current drain of a 6F6-G is 40.5 milliamps. For the 6J8-G, the total current drain excluding the screen current is 6.7 milliamps. For the 6U7-G, excluding the screen current, it is 8.2 milliamps. For the 6B6-G, under resistance coupled conditions, it will be about 0.5 milliamps.

SCREEN SUPPLY

For these three valves, the figures listed are those for a plate supply voltage of 250 volts. However, the characteristics of the valves are such that a small increase in the plate voltage does not materially affect the plate current.

The screens of the 6J8-G and of the 6U7-G are fed from a tapping on a voltage divider network and should not therefore be taken individually. The correct method is to work out the net current drain of the complete screen supply network, adding the figure obtained to the figures already listed.

If, for the sake of example, the screens are supplied from B-plus 266.5 through a 12,500 ohm resistor, and then shunted to earth through a 15,000 ohm resistor, the total current drain of the network is near enough to 8 milliamps.

If the oscillator anode were fed from the divider network, it would also have to be taken into account in the same way.

(Continued on Next Page)

Readers are reminded that the maths article in the July, 1942, issue had to do with voltage divider calculations.

For accurate results, the voltage divider calculation should always be treated in this fashion. However, it is possible to arrive at a fairly close approximation by working out the bleed current of the resistors in the divider network, adding the figure obtained to the total plate and screen current drain of all the other valves.

The total current drain for the whole receiver is therefore 40.5 plus 6.7 plus 8.2 plus 0.5, 8, equals 63.9 milliamps—say, 64.

For a receiver of this nature, it is usual to use a condenser input filter. Reference to the 5Y3-G rectifier curves shows that the d-c output voltage, with an a-c input of 385 volts per plate and a current drain of 64 milliamps, is 424 volts.

As the d-c voltage at the output of the filter is required to be 266.5 volts, it follows that the permissible voltage drop across the filter will be 424 minus 266.5, equals 157.5 volts.

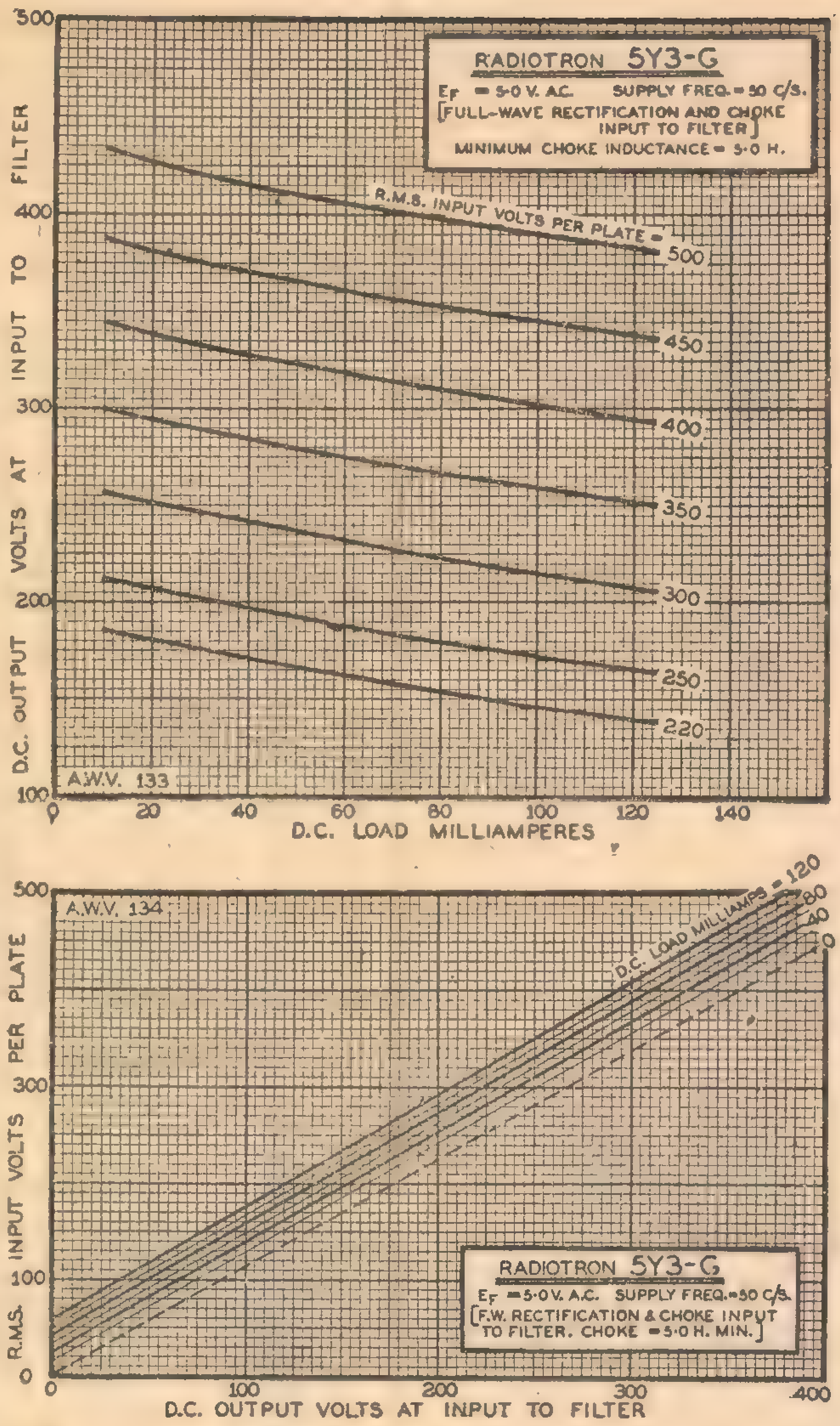


Figure 8. Showing the conventional and the constant current curves for the 5Y3-G rectifier with choke input to the filter. Note that the slope of the transverse lines is less steep, indicating better regulation. However, the output voltage for a given input is much lower than with a condenser input filter.

Since the voltage drop across the filter is to be 157.5 volts and the current drain is 64 milliamps, it follows that the filter should have a d-c resistance of 2460 ohms. Obviously, the nearest standard value is 2500 ohms.

FIELD WATTAGE

The field wattage may be checked by the formula: Watts equals the current in amps squared multiplied by the resistance in ohms.

This works out to be just over 10 watts, a figure satisfactory for most 10 and 12 inch speakers, but rather high for some 7 and 8 inch speakers. The current drain could be reduced by overbiassing the output valve. The high tension voltage would rise as a consequence, but type 6F6-G valves are rated for plate and screen voltages, not including the bias voltage, of up to 285 volts.

In fact, it may be considered desirable as a matter of interest to see how the constants work out on the basis of maximum operating conditions and a field resistance in the vicinity of 2000 ohms. Alternatively, it may be desired to have a 2000 ohm field and a choke with a d-c resistance of about 200 ohms.

If only a very small speaker is to be used, the field resistance may have to be as low as, say, 1000 ohms. In this case, the d-c voltage at the output of the filter would probably be too high, and it would be necessary to bring about an additional drop in voltage by means of a heavy duty dropping resistor.

The value of the resistor would need to be sufficient to make up the total filter resistance to the required figure; the wattage could be calculated by means of the formula mentioned earlier in connection with field wattage.

GENERAL APPROACH

This represents the general approach to the matter of power supply design. First decide upon the required d-c supply voltage and current. Next, determine from the curves the output voltage from the rectifier, and, by subtraction, find the voltage drop across the filter. Finally work out the required filter resistance and check the dissipation in the field coil, if a field coil is used in the filter.

If one does not begin with the assumption of a definite power transformer, the procedure is slightly different. Having decided upon the required d-c voltage and current, choose a resistance for the field to give proper energisation, and then work out the d-c voltage drop across the whole filter network; finally, by addition, find the voltage to be delivered to the input of the filter, and, by reference to rectifier curves, choose a suitable rectifier and a-c input voltage.

As we mentioned earlier, it sometimes requires a certain amount of juggling with the valves to get everything to come out right. Sometimes we seek to accomplish the impossible—or the impracticable—and things cannot be made to work out as they should.

NOT ALWAYS POSSIBLE

For example, we have often received inquiries from people who wish to use a speaker with a 2500 ohm field with a large push-pull amplifier. Assuming the current drain to be 100 milliamps, which is a fairly typical figure, the drop across the field would be 250 volts, and the dissipation 25 watts. If the amplifier requires a high tension voltage of 300 volts, again quite a usual figure, the rectifier would need to deliver an output voltage of 550 volts—and no rectifier will do that with an a-c input of only 385 volts at a current of 100 mA.

The alternatives would be to have the field changed for one of a more suitable value, to try and operate the field other than as a filter or to operate the

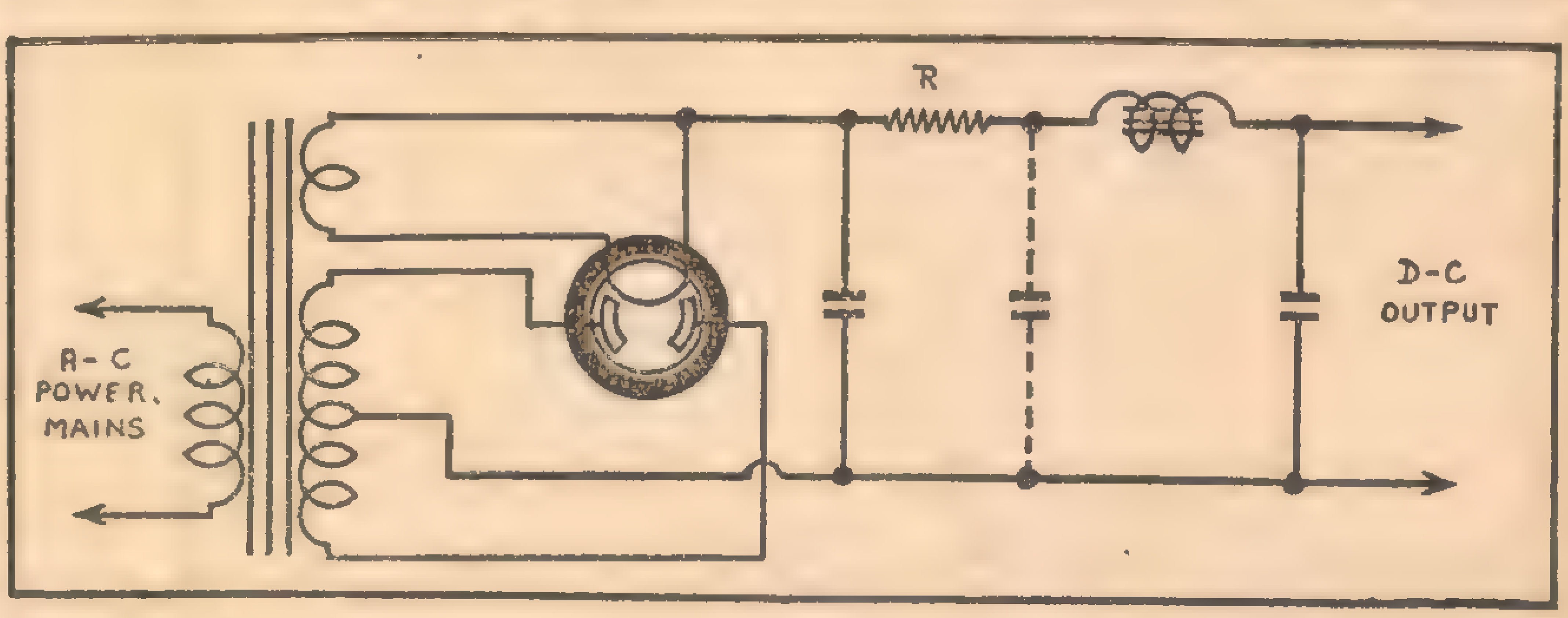


Figure 9. If the voltage from a power supply is unduly high, it may be reduced by connecting a heavy duty resistor in series with the filter inductance, as shown. The addition of the condenser shown dotted is not essential, but it does help in the matter of filtering.

amplifier with greatly reduced high-tension voltage.

A little earlier, reference was made to the use of a voltage dropping resistor. The conventional position for such a resistor is directly in series with the field coil or filter choke, as shown in figure 9. It is more or less immaterial which comes first, as the same voltage drop is introduced in either case.

The use of a dropping resistor gives the opportunity to arrange an extra section on the filter simply by adding one condenser, as shown dotted in figure 9. In this case the resistor may be connected nearest the rectifier, serving to reduce the amount of ripple across the field; however, this is seldom a very important point.

ALTERNATIVE POSITION FOR THE RESISTOR

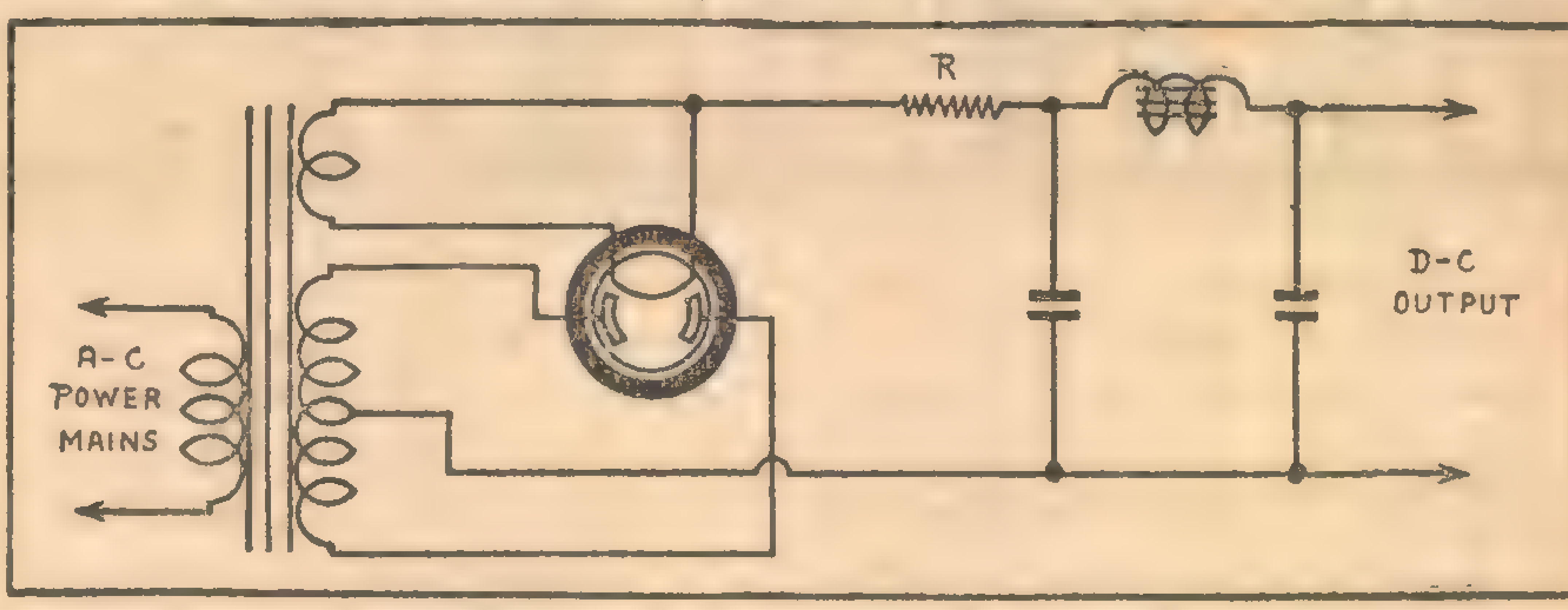


Figure 10. An alternative position for the dropping resistor is immediately between the rectifier cathode and the input to the filter. In this position, the resistor helps to protect both the rectifier and the first filter condenser. However, its d-c resistance cannot be calculated easily.

ALTERNATIVE POSITION

The connection of the dropping resistor in the position shown in figure 10 has certain advantages in that it helps to protect the rectifier against excessive current peaks and reduces the peak voltages across the first filter condenser. The scheme is particularly valuable where large voltage drops are required.

The value of the resistance in this position cannot be calculated simply by Ohm's law. The reason is that, in this position, it carries the charging current of the first filter condenser. In practice, the d-c resistance has to be considerably less than if the resistance were to be connected later in the filter.

Because it carries considerable peak current, a resistor in this position also has to be generously rated as regards wattage. We feel sure that the advantages of using a resistor in this position have not always been fully realised and we intend to look into the matter further.

CURRENT VARIATION

The final point to be covered is in regard to the variation of current drain in a receiver or amplifier with signal.

In a receiver, it is normal for the current drain of certain stages to vary with the A.V.C. voltage or, alternatively, with different settings of the manual gain control. These variations in current usually give rise to variations in high-tension voltage, due to the imperfect regulation of the usual power supply.

In a receiver in which it is important to obtain the maximum gain from the respective stages, it is usual to base all calculations on the assumption of maximum current conditions. With an R-F amplifier valve, such as the 6U7-G, this means a grid bias of -3.0, a screen voltage of 100 volts and a plate voltage of 250 volts.

A.V.C. AND SIGNAL

When the A.V.C. voltage reduces the current drain below maximum, the high-tension voltage will then rise slightly above the calculated figure. For this reason, it is generally advisable to allow a little leeway in the operating conditions of the output valve so that it will not be overloaded by the increased operating voltage

With most power output valves, the cathode current increases slightly with signal, the rise being small with class A amplifiers, but becoming increasingly marked with class AB1, AB2 and class B operation.

With class A operation, it is usually satisfactory to design the power supply on the assumption of no signal input. In the case of a receiver at least, this is usually compensated on local stations, by the reduced drain of the other valves.

Where there is a considerable difference between the no-signal and full-signal current, a problem arises. If the design is based on the no-signal figure, there will be a drop in voltage with signal and a consequent loss of output.

VOLTAGE MAY RISE

On the other hand, if the design is on the basis of full signal cathode current, there is a chance that the voltage will rise to an excessive figure with no signal. The problem is also tied up with the value of the self-bias resistor and a complete analysis is rather out of the question here.

However, the following can be taken as a general guide. If you are planning to operate the output valves under their maximum permissible operating conditions, it is just as well to play safe and to design the power supply on the basis of the no-signal current figures.

Where the contemplated conditions are below the maximum, it is reasonable to design the power supply on the assumption of a current drain midway between no-signal and full-signal conditions.

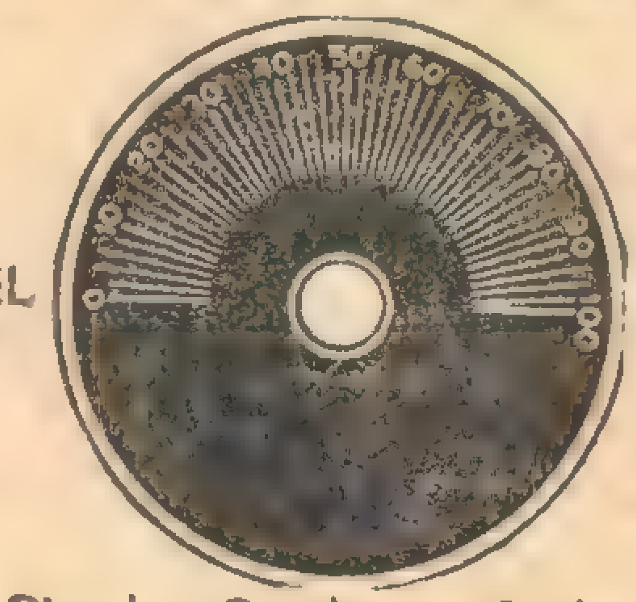
CLASS AB2 AND CLASS B

With class AB2 and class B operation, such an approach to the question usually becomes unsatisfactory and it is necessary to set about designing a supply with as near perfect regulation as possible.

The output valves are affected more by a rise in supply voltage than the voltage amplifiers since, with the latter, there is usually a considerable margin of safety. At the same time, it is advisable to see that the ratings for these valves are not exceeded, even if it means adding extra dropping resistors between the main high-tension supply and the supply to the voltage amplifiers.

Fortunately, most readers will be concerned with receivers and amplifiers using output valves under class A or moderate class AB1 conditions and many of these secondary problems will not be met with.

The foregoing discussion, though perhaps not elaborate, should help our readers to a better understanding of this most important matter.



FURTHER NOTES ON WINDCHARGERS—

Just as we anticipated, the article in our last issue on the subject of Windchargers created quite a lot of interest. From the number of letters already to hand, it is evident that many readers, having perused the article, immediately set about to put their ideas and suggestions on paper. May we take this opportunity to thank the readers who have been so ready to help with data and ideas on this particular subject.

IN the space available, it is not possible to make direct quotation from all the letters, but we will do our best to summarise the points of interest. We may mention that some of the letters came from automobile electricians, who have had quite a lot of experience with car generators and associated apparatus. Perhaps the first point for discussion is that of charging rate.

CHARGING RATE

In order to avoid risk of damage, the charging rate of a radio storage battery should be limited to about 10 per cent. of the ampere-hour capacity. Thus, for a 100 ampere-hour battery, the charging rate should be limited to about 10 amps.

Auto storage batteries are usually designed for heavier charge and discharge currents and a charging rate of up to 20 per cent. of the ampere-hour capacity is permissible. For the average 6-volt car battery, peaks of charging current up to 20 amps are quite in order, provided that the specific gravity of the electrolyte is correct and that the battery is not located in a position where it is exposed to undue heat.

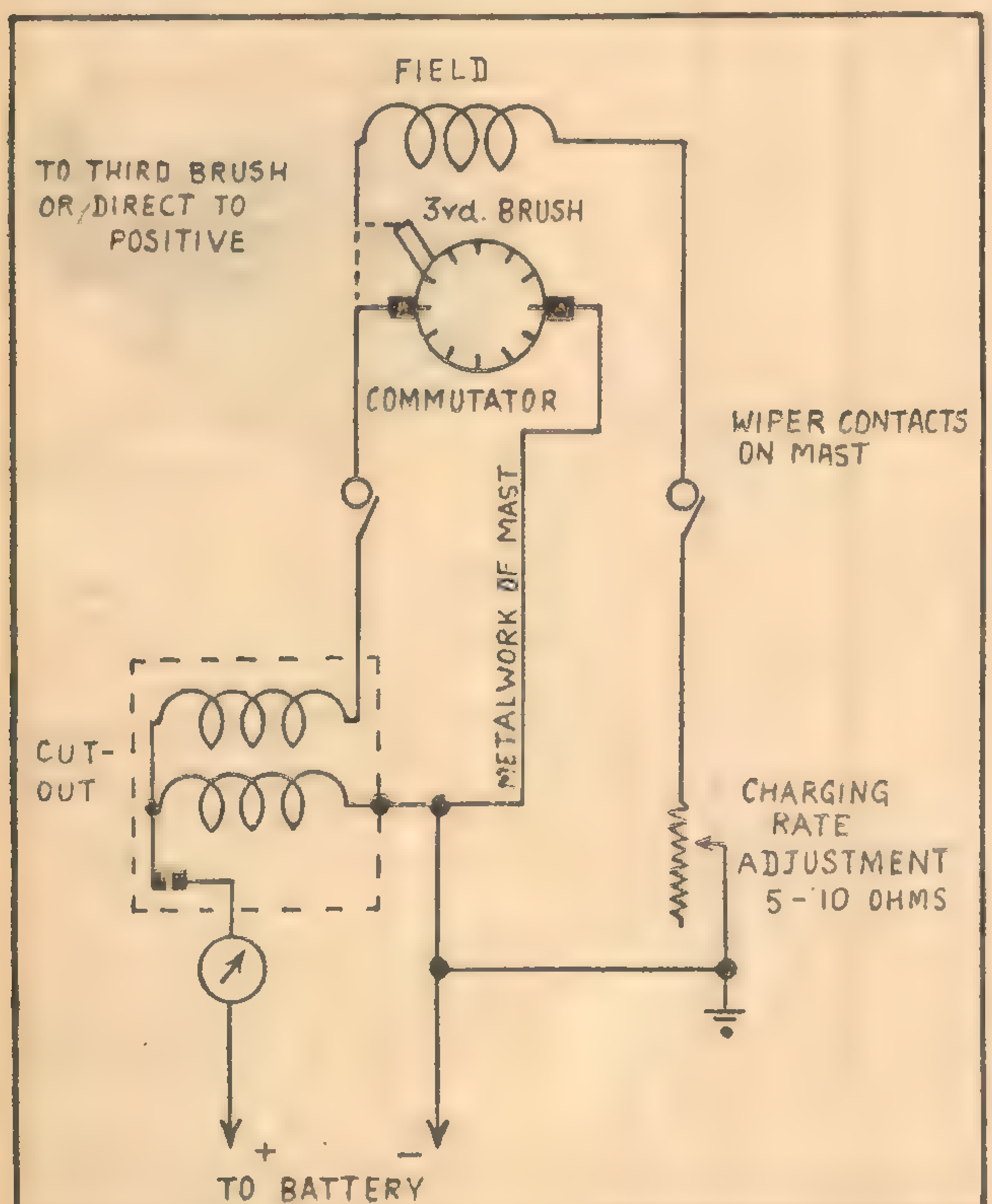
Mr. Leeson, whose home-made windcharger was described in detail last month, mentions that the original model will deliver up to 25 amps in a good breeze.

CONDITION OF GENERATOR

Mr. L. Cohen, of Bradley Bros., Sydney, points out that generators taken straight from junked cars usually need overhauling. They should be dismantled and thoroughly cleaned, the bearings being inspected for undue slackness.

The commutator should be wiped over with a rag moistened with petrol to remove grease and dirt. The point of a penknife should be run along the mica separating the copper segments and any slight projections carefully pared down. The surface of the commutator should then be polished with a piece of worn-out fine-grade glass paper.

The brushes should be inspected and, if unduly worn, replaced with new brushes of exactly the same shape and grade. When the generator has been reassembled, the brushes should be bedded down carefully.



Here is the complete electrical circuit diagram of a windcharger embodying the various suggestions put forward by various readers. Note that the metalwork of the mast is used as the negative connection. There are two wiping contacts, one for the positive side of the charging circuit and the other for the charging rate adjustment. To save unnecessary drag, the third brush may be eliminated altogether, the field being connected direct to the pos- positive brush.

To do this, loop a strip of fine-grade emery paper around one side of the commutator with the abrasive outermost. Allow one brush to rest on the abrasive and, with the commutator free to turn, pull the paper backwards and forwards from the side opposite the brush until the surface of the brush closely mates the curvature of the commutator.

Each brush should be treated in this way, the other brushes being lifted out of the way if necessary.

DIRECTION OF ROTATION

The direction of rotation may be checked by connecting the generator to an accumulator and closing the cut-out contacts so that it runs as a motor; as a generator, it will have to spin in the same direction. If the generator refuses to operate in this manner, the chances are that it is a "dud."

Says Mr. Cohen, "It is a good plan to buy a reconditioned generator or even a new replacement type . . . incidentally, it is possible to have a generator rewound to give a high output at low speed."

Mr. Cohen and Mr. Flynn, of West Maitland, also an auto electrician, point out that it is quite a simple matter to change the polarity of an auto generator to suit requirements.

GENERATOR POLARITY

Auto generators, as manufactured, have no initial polarity. Immediately they are connected across a battery, the fields are magnetised and, thereafter, the residual magnetism determines the polarity. When the generator is rotated, the residual magnetic field is reinforced by a flow of current, usually picked up on the third brush.

To establish the polarity of the generator, it is only necessary to connect it across the terminals of a battery in the desired polarity and to close the cut-out so that it operates for a few seconds as a motor. When the battery voltage is applied, the generator must either be stationary or turning over very slowly.

By this means, it is quite an easy matter to have the insulated terminal as the positive connection and the frame of the generator as the negative.

AUTOMATIC CONTROL

Mr. Flynn also draws attention to the fact that most auto generators are designed to provide automatic limitation of the charging current. Once the cut-out has closed, the charging rate rises gradually until the speed reaches a certain figure, beyond which the current ceases to rise. Actually, the charging rate may tend to fall away slightly above a certain speed of rotation.

This automatic regulation characteristic is useful when charging auto storage batteries, but has limited value when the battery concerned must be charged at a slow rate. The initial charging

WHAT VARIOUS READERS HAVE TO SAY

rate must be adjusted so as to make the best of moderate breezes and the upper limit may be too high for the battery concerned.

On many generators, the initial charging rate is adjusted by sliding a third brush around the surface of the commutator. This third brush controls the excitation of the field magnet.

THE THIRD BRUSH

Mr. Harrigan, of Dorrigo, mentions that position of the third brush has an important bearing on the performance. If advanced too far, the generator is unduly hard to drive; if the charging rate is cut back too far, the operation is inefficient. He says that it is necessary experimentally to strike a balance, taking into consideration such factors as the propeller design and the nature of the wind.

The third brush does not prevent the generator operating at excessive speed, nor is it convenient where a day-to-day adjustment of the charging rate is required.

Several readers have criticised the method of adjusting the charging current as shown in figure 4 in the September issue. Further thought in the matter does indeed reveal a basic weakness.

ADJUSTING CIRCUIT

Auto generators are usually of the shunt-wound type, the field and armature windings being virtually in parallel. Operation of a generator into a high resistance load results in a steep rise in voltage across the generator terminals resulting in overheating and the possibility of a burnout.

For this reason, the windcharger should not be allowed to operate with the battery disconnected, even for a short period.

When charging a two or four volt cell from a six-volt generator, it would be quite in order to have a small series resistor in circuit to limit the current. The net load impedance on the generator could be arranged to be of the same order as that of a six-volt accumulator without the series resistor.

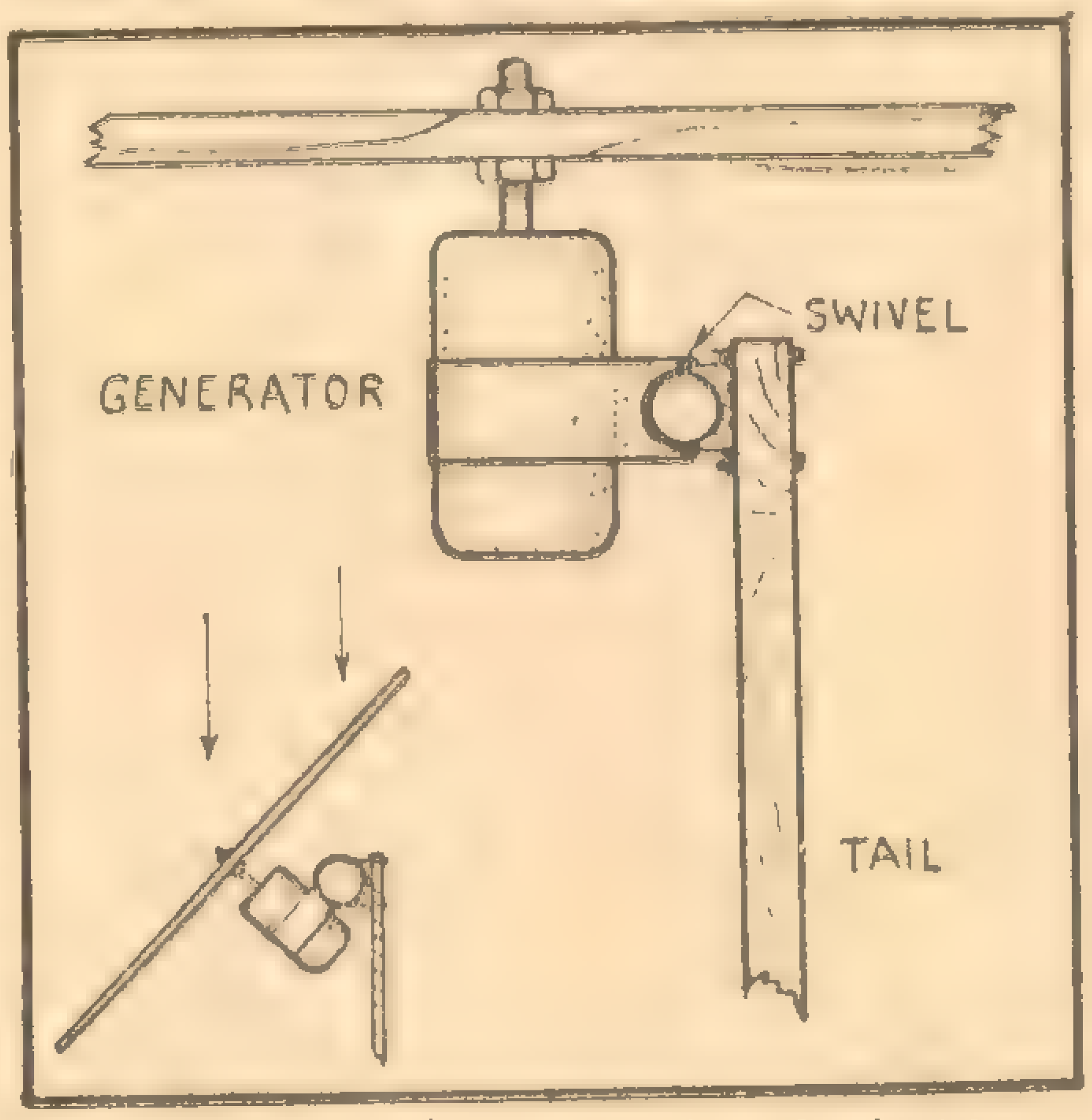
DANGER OF BURNOUT

The danger in the scheme is that too much resistance may be included in the circuit, with the result that the generator may overheat and may even be burned out. However a lot depends on the generator and the maximum speed of rotation.

By way of illustration, one correspondent who has apparently built up a successful windcharger says that he lets the charger run at all times, simply connecting and disconnecting the batteries as required.

The very thought of such a thing is enough to make an auto electrician hold up his hands in horror, but it does show what some get away with. Most generators, under the same conditions, would quickly be reduced to a charred mass.

A scheme which avoids this very real danger is to connect the series resistor in the field circuit, as shown in the accompanying diagram. In most auto generators, one end of the field is returned to the frame and it is necessary to break this connection to allow insertion of the resistor.



Illustrating one method of limiting speed. The generator assembly is offset with respect to the swivel and tail assembly; it is swivelled independently of the tail. In a moderate breeze, the tail and generator are held in alignment by a suitably arranged spring. In a heavy wind, the propeller is forced backwards to an oblique angle with the direction of the wind.

Insertion of the resistor at this end of the field has the advantage that the metal framework of the structure is common to the charging circuit and to the charging rate adjustment. Thus, in addition to the metal structure, two sliding contacts are required to convey all circuits to the foot of the mast.

AVOID LOSSES

As emphasised in the earlier article, it is important to see that the conducting paths have as little d-c resistance as possible, both to protect the generator against overheating and to avoid wastage of power.

Incidentally, Mr. Flynn mentions that the generators on many English cars have one connection to the field already brought out to an insulated terminal. Its purpose is to facilitate the introduction of a series resistor usually controlled by the "half-charge" switch.

Mr. Kelvin Phillips, of Howqua, suggests that it is a good plan to cut out the third brush altogether, supplying the field from the positive brush through a series resistor. Obviously this scheme could be combined with the previously mentioned scheme for controlling the charging current, connecting one side of the field direct to the positive brush and returning the other side to the frame through the adjustable resistor.

Mr. Phillips claims that the elimination of the third brush reduces the drag to a worthwhile degree. Indeed, there are apparently quite a number of generators with only the two brushes to begin with.

COMPLETE CIRCUIT

The accompanying circuit diagram embodies the various ideas mentioned so far. Owing to lack of space, we have been able to do no more than pass on the ideas, having to omit lengthy discussion as to how to put them into practice. If you are unable to identify the various leads and terminals on your generator, take it along to the nearest auto electrician for advice.

One correspondent emphasises the importance of adjusting the cut-out, since precise opening and closing is more important than in a car. Make sure that the surfaces are flat and clean and that the points close squarely. In most cut-outs, the frame forms one connection.

Mr. Harrigan, of Dorrigo, says that, if the wheel revolves for any length of time at less than charging speed, the commutator appears to become glazed over and the generator will not begin to charge as readily as it should. He advises mounting the cut-out in a convenient position so that the points can occasionally be squeezed together when the generator appears to be slow in commencing to charge.

(Continued on Page 43.)

WORK OUT YOUR OWN MATHS PROBLEMS

Following on from our last issue in which we briefly reviewed fractions and decimals, we now propose to show how the square root of any number can be determined. In the course of your radio work it will frequently be found that the square root of a certain number is required, so a good working knowledge of the method will not go amiss.

by C. E. Birchmeier

HOWEVER, before passing on to deal specifically with square roots, let us find out what is meant when we refer to a power or a root. The power of a number is simply the number of times it is to be used as a factor or multiplier. The power of a number is denoted by a small figure placed just above and to the right.

SQUARE, CUBE, &c.

Thus, a small figure 2 placed just above and to the right of a number indicates that the number is to be raised to the second power or multiplied by itself. A number raised to the second power is said to be "squared."

A small figure 3 to the right of a number indicates that the number is to be raised to the third power or "cubed." A small figure 4 indicates that a number is to be raised to the fourth power.

Thus, 5 cubed really means 5 x 5 x 5, which works out to be 125.

Similarly, 5 raised to the fourth power means 5 x 5 x 5 x 5. You will note how much easier it is to add a small figure to indicate the power of a number than to write down a whole series of numbers as above.

The figure denoting the power of a number is usually referred to as the exponent or index.

Numbers without an exponent are understood to be of the first power. It would be quite correct to add a small figure 1 to all such numbers, but that would be needless complication. However, it is a handy little point to keep in mind.

ROOT OF A NUMBER

The converse of the power of a number is the root. The square root of a given number is that number, which when raised to the second power (or squared), equals the given number. The cube root of a given number is that number which, when cubed, equals the given number.

Thus, the square root of 9 is 3, because 3 squared is equal to 9. The cube root of 27 is 3, because 3 x 3 x 3 is equal to 27. The fourth root of 16 is 2, because 2 x 2 x 2 x 2 is equal to 16.

These are only very simple examples, but you should be able to grasp the idea.

The root sign, sometimes referred to as the radical sign, is as follows:—

$$\sqrt{}$$

As the sign stands, it denotes the square root. To denote the cube root, a small figure 3 is added just to the left, in the "V" portion of the sign. A small figure 4 in the same position indicates the fourth root and so on.

Now that we have refreshed your memory as to the significance of powers and roots, we can call to mind the arithmetical method of working out the square root of a given whole number. In radio work, square roots are very frequently met with.

FINDING SQUARE ROOT

The method of finding the square root of any number can best be understood by considering a specific example, so let us find the square root of 222784. Now first of all set down the number and mark off the digits into pairs, starting from the right, thus:—

22, 27, 84.

Now the largest number whose square is contained in the first group is 4, so we set down the square of this number (being 16) under 22, and subtract, which gives us 6. The next two digits, 27, are brought down, giving 627. Set the double of 4 (which is 8) to the left of the 627 and divide. Now 8 goes into 62 seven times, so place this 7 after 4 in the first line, and also after 8 in the

```
     )22,27,84( 472
      16
   87) 627
       609
  942) 1884
       1884
       ....
```

third line. Multiply the 87 by the 7 and we have 609, which is placed under the 627. By subtracting, we obtain 18 and on bringing down the last two figures, 84, make 1884.

Now double the 47, which is 94, and place it to the left of the 1884. By inspection, 94 divides into 188 twice, so put this 2 to the right of the 47 and of the 94. This gives 942 multiplied by 2, which is placed under the 1884.

On subtraction there is no remainder so 472 is the square root of 222784.

Actually, very few square root calculations come out as obligingly as this, and there is usually a remainder. The remainder may be ignored, or you may carry on past the decimal point, bringing down noughts in pairs. It all depends on the order of accuracy which you require.

ROOTS OF DECIMALS

In some cases we may have a decimal point in the original number to consider. For example, suppose we wish to find the square root of 147.1369. As before, the first step is to mark the various digits off into pairs, working from the right to left, for the whole numbers and vice versa for the decimal portion, in which case we obtain:—

1,47.13,69

From here the balance of the calculations are carried out similarly to those shown in the previous example, except that as soon as any part of the decimal fraction of the number is brought down, a decimal point must be placed in the square root. Bearing these points in mind, we find the example quoted works out to give 12.13 as the square root.

Now should you ever encounter a number such as 0.018769 the digits are marked off into pairs working from the left to the right, which gives 0.01,87,69, and if you care to work this out for practice, you should obtain 0.137 as the square root.

So much for square roots. If you are doubtful at all on any of these points, then we suggest you obtain a good mathematical textbook and practise working out examples until you are quite familiar with the operation.

EXPONENTS, INDICES

As previously explained, an exponent is the number which indicates how many times a particular number is to be taken as a factor. Thus 4 cubed is another way of expressing 4 x 4 x 4. When dealing with multiplication and division, involving indices, there are certain definite laws to be adhered to. Now suppose you had to find the value of 5 squared, multiplied by 5 to the fourth; how could you work this out?

Writing it out in full we would have:

$$5^2 \times 5^4 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$$
$$= 5^6$$

Thus we obtain our first fundamental rule for the handling of indices. To find the product of two or more powers of the same number, you simply add the indices. Thus:—

$$3^2 \times 3^5 \times 3^8 = 3^{2+5+8} = 3^{15}$$

Now suppose we had to divide 5 to the sixth by 5 cubed. In this case we determine the result by setting out the sum as follows:—

$$\frac{5^6}{5^3} = \frac{\cancel{5} \times \cancel{5} \times \cancel{5} \times 5 \times 5 \times 5}{\cancel{5} \times \cancel{5} \times \cancel{5}}$$

$$= 5^3$$

Thus it follows that when we have division of similar numbers, involving exponents or indices, the exponent of the denominator is subtracted from the exponent of the numerator to give the exponent of the quotient. A further example will make this quite clear:—

$$10^7 \div 10^4 = 10^{7-4}$$

$$= 10^3$$

For the time being, consider this rule as applying when the exponent of the numerator is larger than that of the denominator.

POWER OF A POWER

On odd occasions, we may have to square or cube a number which is already a power. Thus, it might be necessary to square 7 cubed. Again, it might be necessary to cube the fourth power and so on.

Taking the first example and writing it out in full, we would have 7 x 7 x 7 multiplied by 7 x 7 x 7. This is obviously 7 to the sixth power.

Thus, when squaring or cubing a number which is already a power, you multiply the indices. When taking a root of a number which is already a power, you have to divide the indices.

Summarising these three rules we obtain the following laws pertaining to indices:—

(1) To multiply powers of the same quantity—add the indices.
(2) To divide powers of the same quantity—subtract the indices.
(3) To find the power of a power—multiply or divide the indices as required.

FRACTIONAL EXPONENTS

So far we have been considering only positive and integral indices, but it should be mentioned that there are also fractional and negative indices. Since these are sometimes encountered, let us see what they are all about.

For instance, have you ever seen a term such as 9 to the power ½, and wondered what it could possibly mean? Using law (1) let us multiply 9 to the power ½ by itself, and see what happens.

$$9^{\frac{1}{2}} \times 9^{\frac{1}{2}} = 9^{\frac{1}{2}+\frac{1}{2}}$$

$$= 9^1 = 9$$

Thus we find that 9 to the power ½ is such a quantity that, when multiplied by itself, gives 9. In other words, 9 to the power ½ is the square root of 9. The use of the fractional exponent is an alternative way of expressing a root.

The number 9 to the power ½ is simply the square root of 9. The number 16 to the power ¼ is simply another way of signifying the fourth root of 16.

The same idea can be carried on to more complicated fractions. Thus 5 to the power ¾ means the fourth root of the cube of 5. However, this is getting rather more involved than necessary for most radio work. The main point is to appreciate the significance of fractional indices. If you meet fractional indices at all in radio calculations, the fractions will probably be no more formidable than one-half or one-third.

The final point to cover is in regard to negative indices. Just before discussing them, let us clear up one little matter which sometimes confuses people.

When the indice of any number is 0, the mathematical value is simply 1, irrespective of what the number is. If you cannot follow this, just check through the steps of the following in the light of the previous discussion.

$$\frac{6^3}{6^3} = 6^{3-3} = 6^0$$

Now we know that 6 cubed divided by 6 cubed is equal to 1, just as 4 divided by 4 is equal to 1. It follows then that 6 to the power 0 is also equal to 1. The same is true for any other number.

Now, let us consider a number with a negative exponent, say 5 to the power —3. If we multiply this by 5 cubed over 5 cubed, we will not alter the value, but some interesting things will happen.

$$5^{-3} = 5^{-3} \times \frac{5^3}{5^3}$$

$$= \frac{5^{-3+3}}{5^3}$$

$$= \frac{5^0}{5^3} = \frac{1}{5^3}$$

So we find that the expression 5 to the power —3 is just the same thing as 1 over 5 cubed. Similarly, 7 to the power —4 is exactly the same as 1 over 7 to the fourth.

If you refer again to the discussion on dividing powers of the same number, you will remember we stated that this is accomplished by subtracting the exponent of the denominator from that of the numerator.

At that stage we could not very well discuss the case where the exponent of the denominator was greater than that of the numerator, since the result would have been negative. At this stage in the discussion, negative exponents no longer cause concern.

Thus 3 to the fourth power, divided by 3 to the sixth power, gives the result of 3 to the power —2, or 1 over 3 squared.

An exponent may be both fractional and negative. Thus 3 to the power —½ is the same as 1 over root 3. The number 4 to the power —¼ is the same thing as 1 over the fourth root of 4.

We will follow on from this juncture in the next issue, and show you how very involved calculations can be considerably simplified by applying the principles of the powers of ten, and also if space permits, deal with the applications of logarithms.

CAN YOU MANAGE THESE?—

1. Find the square root of 207936, 3312400, 1079521, 32239684.
2. Find the square root of 37·21, 1200·6225, 1532·7225, 0·0289.
3. Find the square root of the product of 50836900 and 0·000001.
4. Find the value of $\frac{0{\cdot}0132 \times 0{\cdot}543}{7{\cdot}65 \times 0{\cdot}0301}$.
5. Express in radical form $12^{\frac{1}{3}}$, $5^{\frac{1}{4}}$ $6^{\frac{3}{4}}$, $3^{\frac{1}{2}}$.
6. Find the value of $(10^4)^3$, $(10^2 \ 10^3)^3$.
7. Find the value of $\left[\frac{8 \times 10^4}{2 \times 10^3}\right]^2 \sqrt{0{\cdot}00081 \times 0{\cdot}009}$.

YOUR ANSWERS

1. 456, 1820, 1039, 567[illegible]
2. 6·1, 34·65, 39·15, 0·17.
3. 7·13.
4. 128·99.
5. $\sqrt[3]{12}$, $\sqrt[4]{5}$, $\sqrt[4]{6^3}$, $\sqrt{3}$.
6. 10^{12}, 10^{15}.
7. $1{\cdot}6 \times 10^3$, $2{\cdot}7 \times 10^{-8}$.

6F7 as a Diode-Pentode

NOT all readers realise that the old 6F7 valve can be used, in many circuits, to replace the 6B7S or its octal equivalent type, 6G8-G. At first glance the types do indeed seem to be quite different, since one is a triode-pentode and the other a duo-diode-pentode.

However, the pentode sections in each type are electrically identical, so that the pentode portion of the 6F7 will replace that of the 6B7S or 6G8-G without any change to the electrical circuit.

Furthermore, the triode grid of the 6F7 may be utilised as a diode, so that the 6F7 may be used in place of the 6B7S or 6G8-G in any circuit where the two diodes of the latter types are connected together. Even where separate diodes are required, it may be possible to rearrange the circuit to use a single one. The triode plate is simply connected to the cathode or to earth.

The same remarks apply also for the 6P7-G, which is the octal-based equivalent of the 6B7S.

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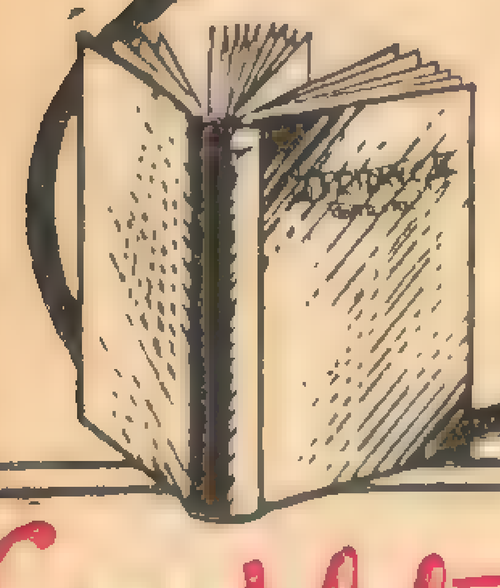

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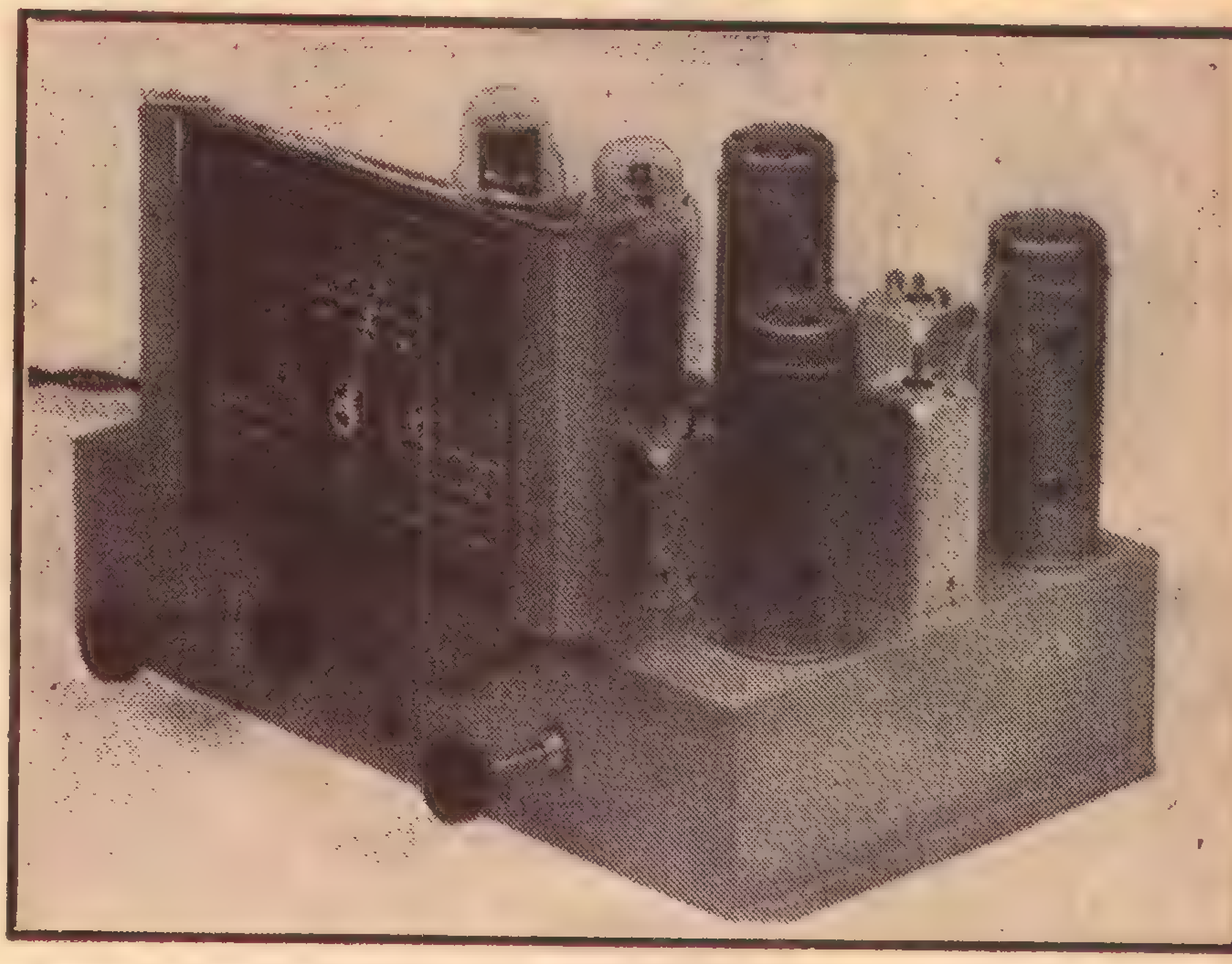
THE "JEEP" FIVE VALVE B/C RECEIVER

In a recent article in this magazine L. B. Montague referred to a "Jeep" as a motor car reduced to its bare essentials — a vehicle with no fancy trimmings but nevertheless extremely useful and reliable. Well, then, may we introduce the equivalent in a radio receiver, the "Jeep" five-valver.



Despite its simplicity, the receiver has a neat and workmanlike appearance. There are three controls in all, for tuning, tone and volume. The dial used in the original was an edgelit glass dial of medium dimensions. There are quite a number of alternative dials available, although the fitting of some of the larger ones necessitates enlarging the cut-out in the front of the chassis.

THIS circuit has been developed to meet the increasing demand for a receiver to give good average performances with not more parts than necessary. The present version has been built up and described as a broadcast receiver but it may be converted for dual-wave reception by the simple expedient of using a suitable chassis and adding a dual-wave bracket in place of the broadcast coils. The electrical circuit would not need to be modified.

By far the greater number of a-c receivers at present in use employ four valves and a rectifier. The reason is simply that such receivers most nearly meet the requirements of the majority of listeners. For those who want compactness and economy there are smaller receivers, and larger receivers for those who want high sensitivity and power output.

As far as 4/5 valve receivers are concerned, they have been built up and sold in styles ranging from the simplest possible arrangements to quite complicated receivers with all manner of refinements and controls.

SIMPLICITY AIMED AT

In designing this particular receiver we have kept in mind the requirements of the man who wants nothing more than a straightforward honest-to-goodness circuit which will match the average commercial receiver in performance and which is both cheap and easy to construct.

We have kept in mind, too, the fact that parts are scarce, and the fewer parts there are the less likelihood there is of the construction being held up. This is a very real consideration under the present circumstances.

There is ample evidence that constructors are avoiding complicated circuits because of the fear that they will get the job half done and then have to give it up. Whether such an attitude is justified is open to debate; certainly there may be hold-ups, but careful investigation beforehand will usually be sufficient guard against disappointment along these lines.

However, all that is by the way and the job on hand is to describe this simple 4/5 valve receiver.

It goes almost without saying that a standard receiver along these lines has no R-F stage. The inclusion of an R-F stage in any receiver helps in the matter of selectivity, sensitivity, and signal-to-noise ratio.

NO R-F STAGE

This is valuable in a receiver intended for long-distance or short-wave reception, but, for a receiver which is used mainly for local reception, the general verdict seems to be that the R-F stage can be sacrificed without detracting unduly from the entertainment value of the receiver.

by W. N. Williams

This does not mean that a 4/5 valve receiver is not capable of long-distance reception. On the contrary, any good 4/5 receiver will give a good account of itself on interstate and short-wave stations, if it has a reasonable aerial and is not hard against some powerful transmitter.

An R-F stage is always helpful, but its practical value has to be balanced against the extra cost and complication.

To make the best of a 4/5 valve receiver in the matter of selectivity and sensitivity it is most important to use the best coils that can be acquired. Ordinary solenoid coils will certainly work, but air-cored honeycomb litz coils do a better job. Iron-cored coils are usually better still.

The same is true, perhaps to an even greater extent, of the I-F transformers. The old style air-cored transformers are hopelessly inadequate in a modern receiver, and even air-cored honeycomb litz transformers leave much to be desired. Once again, iron-cored or permatune I-F transformers are a good investment.

A POINT TO NOTE

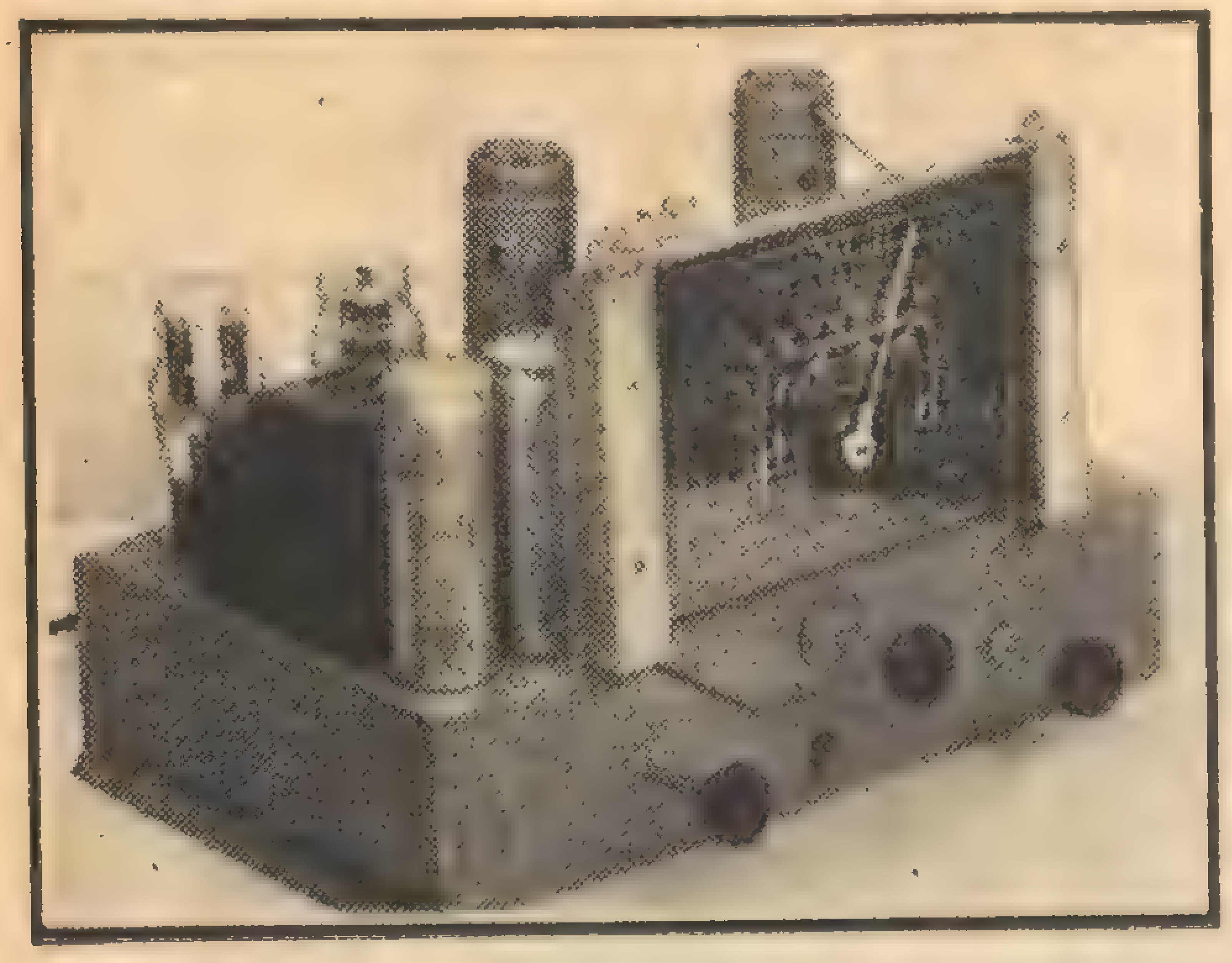
The use of poor coils and I-F transformers inevitably result in poor selectivity and perhaps low gain, which no amount of juggling with the circuit will correct.

Not all readers seem to recognise this point. We often receive letters requesting circuits of receivers of a specified type " . . . which must be sensitive and selective." The whole point of the matter is that these properties are governed more by the quality of the coils and I-F transformers used than by the details of the circuit.

Unfortunately, the better the selec-

(Continued on Next Page)

SIMPLICITY IS THE KEYNOTE



Another view of this month's simple receiver. The power transformer should preferably be an 80 milliamp type, although a 100 or even a 125 milliamp type would be quite OK. A 60 milliamp transformer would be fully loaded and might overheat. Only a few of the more fortunate ones will be able to procure wet can-type electrolytic condensers.

tivity of the receiver, the greater is the sideband cutting and the poorer is the high-note response. Unpleasant though it may be, that is the way things work out. In a simple receiver you just cannot have high selectivity and wide frequency response at the one and same time.

However, most people are quite content with the order of selectivity and tonal quality obtained from the average receiver using iron-cored coils and I-F transformers.

In this receiver there are two variable tuned circuits, namely, the oscillator and the aerial circuits. A two-gang tuning condenser is therefore required.

GANG CONDENSER

The standard gang these days is the H type and is usually supplied without trimmers. Used in conjunction with the proper coils and tuning dial, this gang will tune right across the broadcast band from 550 to 1600 kcs. and will track with station calibrations.

Gangs other than the H type will not track properly with dials designed for the H gang, and they may also fail to cover one or other extreme end of the band, due to differences in the maximum and minimum capacitance figures. This latter point may or may not worry you.

Of course, if you happen to have on hand some other type of gang together with dial and coils designed for it, these should match up quite satisfactorily. The trouble comes about when one tries to use gang, dial and coils which have not been designed for use one with the other.

THE TRIMMERS

If your gang has trimmers attached, these will serve to trim up the tuning circuits when the receiver has been completed. Unscrew the trimmers, clean the mica and see that the adjustment works smoothly. If your gang is not fitted with trimmers, these will need to be added.

The trimmers can be soldered directly to the gang terminals or across the secondaries of the coils beneath the chassis. If soldered to the gang, one side will have to connect to the stator plates and the other to the frame and rotor plates.

Whether the trimmers are connected across the gang or the coils, make sure that the outer or moving vane goes to the "cold" side of the circuit. If this precaution is not taken, the setting of the trimmer will be affected each time the screwdriver makes contact with the adjusting screw.

VALVE TYPES

The receiver was designed to give the widest possible choice of valve types, including metal and glass types. valves with octal or old-style bases and valves with 6.3 or 2.5 volt heaters. The various alternatives are listed or mentioned in the article and this should be a distinct help in these times when valve supplies come and go with amazing rapidity.

The preferred valve line-up is as follows: 6J8-G, 6U7-G, 6B6-G, 6F6-G, and 5Y3-G. Generally speaking, any of the other alternatives listed or mentioned elsewhere may be substituted without having any marked effect on the performance of the receiver.

The underneath wiring diagram has been drawn up on the assumption that the above five types are used. However, it will be correct for all the octal based equivalents. If metal valves are used, it will be necessary to earth the pin connecting to the metal shield.

When using valves with old-style bases, the underneath wiring diagram may be taken as a general guide but due allowance will have to be made for the different sockets. For the 2.5-volt series, it will naturally be necessary to provide a 2.5-volt heater supply.

2.5 AND 6.3V. VALVES

If you are unable to obtain all the preferred valve types, there is no objection from the point of view of performance to mixing the valve styles, whether metal, octal or old-style glass or with 6.3 or 2.5 volt heaters. However, it is good to aim at consistency for the sake of others who may have to service the receiver at a later date.

It is probable that many will have on hand a 58 and 2A5 and a 2.5-volt power transformer but will be unable to buy, say, the 2A6 and 2A7. In this case, the best thing to do would be to buy the 6.3-volt octal equivalents of the missing valves, adding a small filament transformer to supply the heaters.

At a later date, when one or other of the 2.5-volt valves requires replacement, rearrange the heater wiring and replace the old valve with a modern 6.3-volt octal type. Ultimately, the receiver will have a complete kit of modern 6.3-volt valves

The main point is to watch the dif-

(Continued on Page 36)

This rear view shows very clearly where all the major parts fit in. The two coils are alongside the gang condenser, the aerial coil being nearer the dial. The first three valves are shielded; the converter is in the front corner of the chassis, the I-F amplifier behind it. The diode-triode is alongside the output valve. Note the trimmers, which have been attached to the gang.

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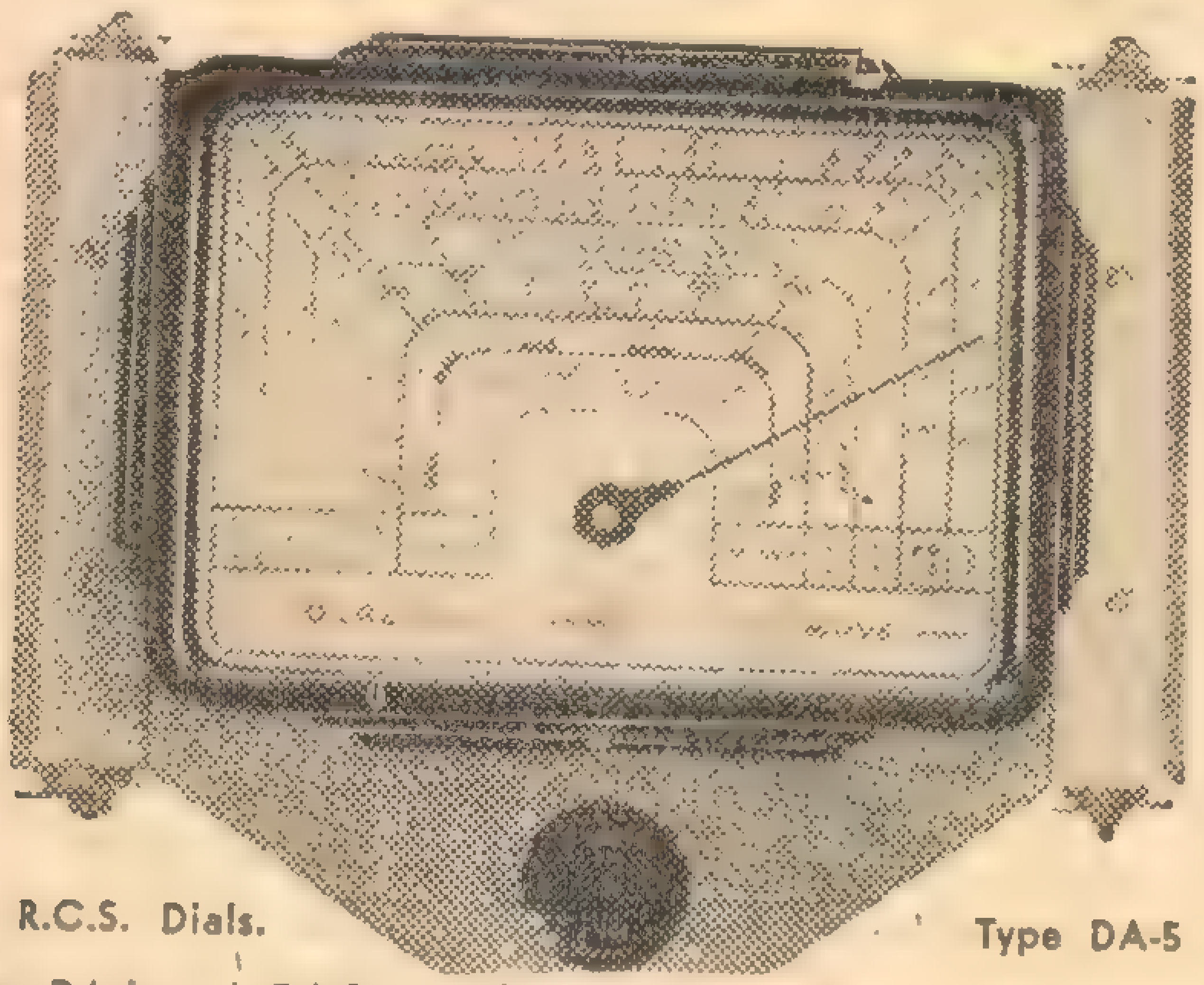

R.C.S. Dials. Type DA-5

Types DA-1 and DA-2 are single glass dual-wave, the type DA-2 having been designed especially for use with the Five-Band Communications Coil Kit and "H" type condenser. Type DA-1 is a standard dual-wave dial for use with R.C.S. coils and "F" type condenser. The DA-5 dial is for use on the 1600 to 550 k.c. and 13.7 to 40 metre bands, with "H" type condenser. All this series is edge-lit and wedge-driven. Aperture for the escutcheon is approximately 7in. x 4⅞in.

DA1 Standard D/W Dial, "F" condenser	22/6
DA2 Communication Dial	22/6
DA-5 13.7 to 40 metres D/W Dial, "H" condenser	22/6
DA-6 Mantel Set Dial, D/W "H" gang	18/9
DA-7 Portable Kit Dial, D/W "H" gang	9/-
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The new R.C.S. permeability-tuned I.F.'s are wound on special Trolitul formers into which are inserted the adjustable iron cores. These R.C.S. permeability-tuned I.F.'s are the most dependable and efficient I.F.'s it is possible to produce. They should be used whenever the optimum in results is required.

465 K.C. I.F.'s.

When two I.F.'s are used:

IF162	13/9	IF163	13/9

When three I.F.'s are used:

IF164	13/9	IF166, 1st I.F.	7/6
IF163	13/9	IF167, 2nd I.F.	7/6

Air Core 175 K.C.

IE68, 1st I.F.	7/6	IE69, 2nd I.F.	7/6

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E343 R.F.	6/6	E346 R.F.	8/6
E344 Osc.	6/6	E347 Osc.	8/6

T.R.F. TYPE "H" GANG AIR CORE

T88 Aerial	6/6
T89 R.F.	6/6
T87 R.F. with reaction	6/6

Type E342

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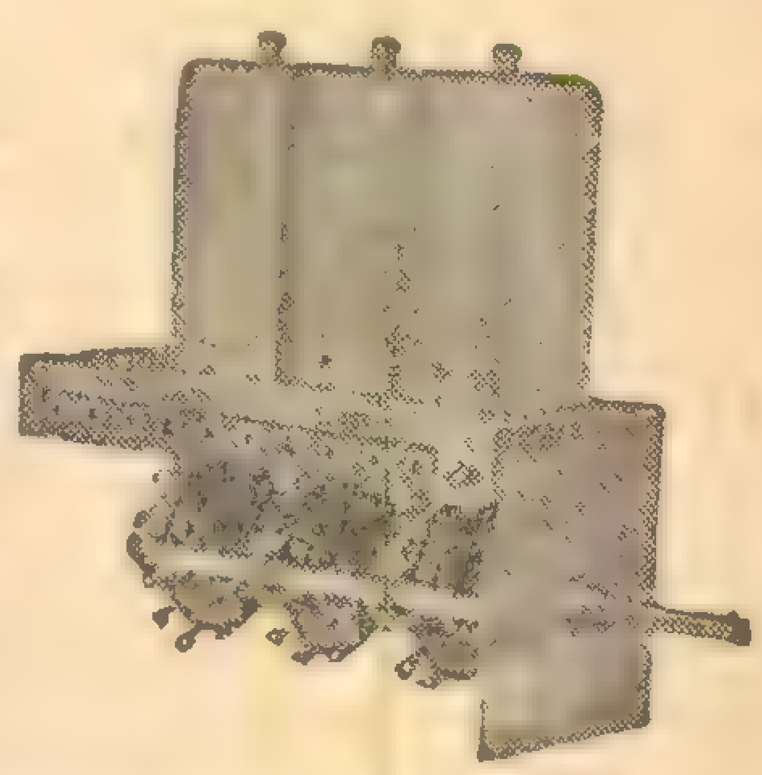
Code DW-35 ., Price, £3/7/6



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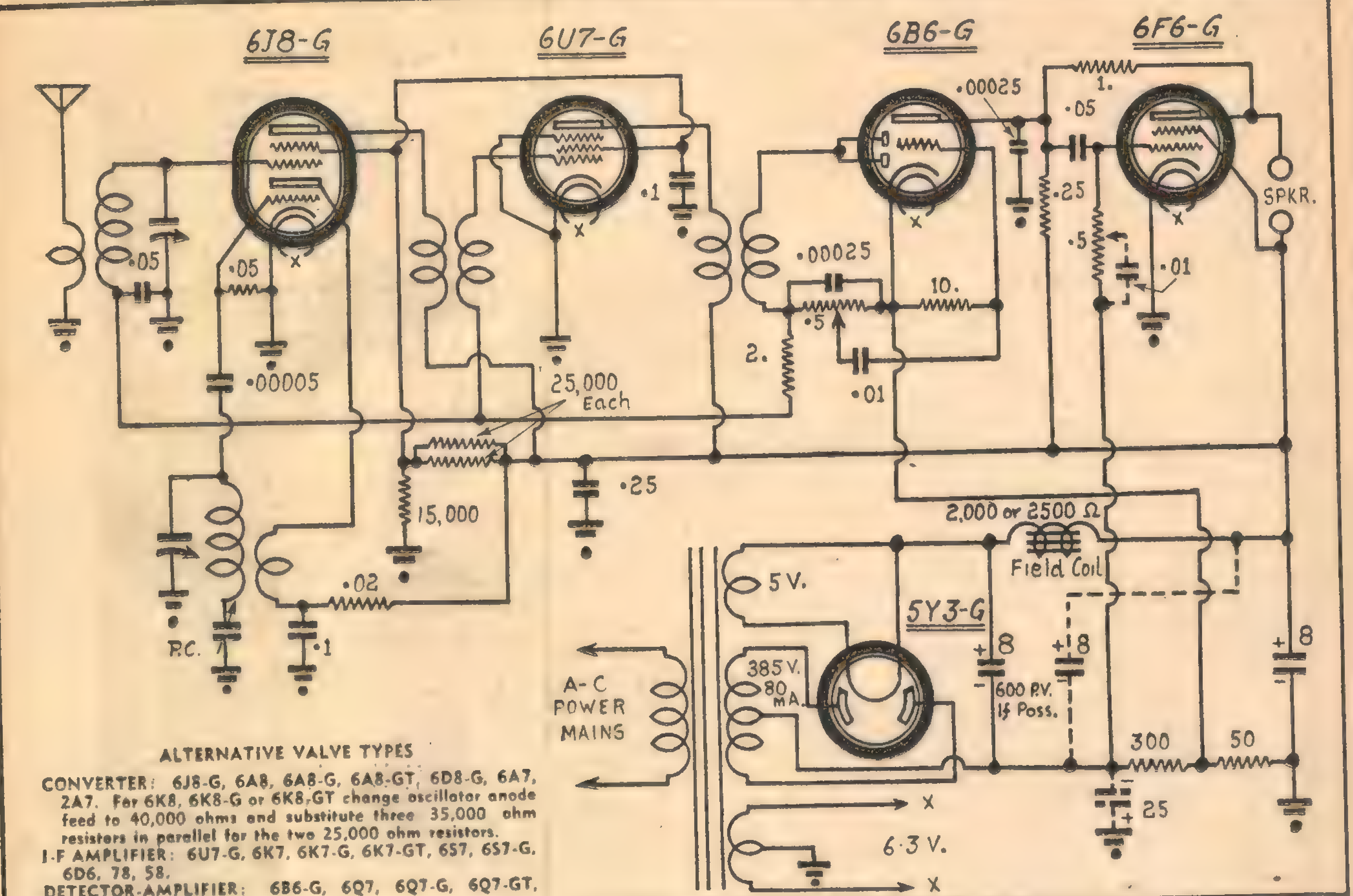
SCHEMATIC CIRCUIT DIAGRAM OF THE SIMPLE 5-VALVE RECEIVER



ALTERNATIVE VALVE TYPES

CONVERTER: 6J8-G, 6A8, 6A8-G, 6A8-GT, 6D8-G, 6A7, 2A7. For 6K8, 6K8-G or 6K8-GT change oscillator anode feed to 40,000 ohms and substitute three 35,000 ohm resistors in parallel for the two 25,000 ohm resistors.
I-F AMPLIFIER: 6U7-G, 6K7, 6K7-G, 6K7-GT, 6S7, 6S7-G, 6D6, 78, 58.
DETECTOR-AMPLIFIER: 6B6-G, 6Q7, 6Q7-G, 6Q7-GT, 6T7-G, 75, 2A6.
OUTPUT VALVE: 6F6-G, 6F6, 6F6-GT, 6V6, 6V6-G, 6V6-GT, 6K6, 6K6-G, 42, 41, 2A5, 47.
RECTIFIER: 5Y3-G, 80, 5Y4-G.

The circuit diagram of the "Jeep" five valve receiver. Note method of feeding the screens of converter and I-F amplifier valves and back-bias system. Designed to allow the widest selection of valve types.

ferent socket and heater requirements for the different valves you may have to use.

For the converter, the preferred type is the 6J8-G. However, by suitable choice of the component values, it has been possible to arrange matters so that a 6A8, 6A8-G, 6A8-GT, or 6D8-G may be directly substituted without any change whatever to the wiring or operating conditions.

A 6A7 or a 2A7 may also be used, although the 6A7 will require a different socket and the 2A7 a different socket and heater voltage.

FOR 6K8 CONVERTER

The 6K8, 6K8-G, and the 6K8-GT have the same socket connections as the 6J8-G, but there are considerable differences in the electrical characteristics. Although the 6K8-G may actually be found to operate in place of the 6J8-G, it is strongly recommended that a change be made in the voltage supply networks.

For the 6K8, 6K8-G, or 6K8-GT, the 20,000 ohm series resistor in the oscillator anode circuit should be changed to about 40,000 ohms; one of 35,000 ohms would probably do quite well. Further, in view of the higher screen current, the two parallel 25,000 ohm resistors should be replaced with three 35,000 ohm resistors in parallel

The oscillator circuit is quite conventional and does not warrant any special comment. As in the case of the trimmers mentioned earlier, see that the outer or moving vane of the padder is connected to earth so that the adjustment is not affected when you touch the adjusting screw with a screwdriver.

The I-F transformers have already been discussed and need little further comment. Note, however, that there is usually some difference between the first and second transformers in a kit. The first transformer should follow the converter valve, the second being connected between the I-F amplifier and the diode detector. The transformers should not be interchanged.

The preferred valve for the position of I-F amplifier is the 6U7-G. However, the 6K7, 6K7-G, 6K7-GT, 6S7, or 6S7-G may be regarded as direct equivalents. As previously mentioned, if a metal 6K7 or 6S7 is used, it will be necessary to earth pin 1, connecting to the shell.

With a change of socket, types 6D6

YOU WILL NEED THESE PARTS:

- 1 Chassis, 14 x 8½ x 3.
- 1 Power transformer, 385v. CT. 385v., 80 milliamps, 6.3v at 3 amps, 5v. at 2 amps.
- 1 Coil kit aerial, oscillator, 2 I-F transformers.
- 1 2-gang tuning condenser.
- 1 tuning dial to suit.
- 1 465kc. padder.
- 2 8 mfd. electrolytic condensers, including one 600 p.v. if possible).
- 1 8 mfd. tubular condenser (optional).
- 1 25 mfd. tubular condenser (optional).
- 1 .25 mfd. tubular condenser.
- 2 .1 mfd tubular condensers.
- 2 .05 mfd. tubular condensers.
- 2 .00025 mfd. mica condensers.
- 2 .01 mfd mica condensers.
- 1 .00005 mfd. mica condenser.
- 1 50,000 ohm resistor, 1 watt.
- 2 25,000 ohm resistors, 1 watt.
- 1 20,000 ohm resistor, 1 watt.
- 1 15,000 ohm resistor, 1 watt.
- 1 10 meg. resistor, 1 watt.
- 1 2 meg. resistor, 1 watt.
- 1 .25 meg. resistor, 1 watt.
- 1 1 meg. resistor, 1 watt.
- 1 300 ohm ww resistor.
- 1 50 ohm ww resistor.
- 2 .5 meg. potenticmeters.
- 2 trimmers (if required).

SOCKETS: 1 4-pin, 5 octal.

SPEAKER: 2,000 or 2,500 ohm field transformer matched to 6F6-G.

VALVES: 1 6J8-G, 1 6U7-G, 1 6B6-G, 1 6F6-G, 1 5Y3-G.

SUNDRIES: 2 dial lamps, 3 knobs, 2 terminals, 3 valve shields, 3 grid clips, braided wire, hook up wire, nuts and bolts, 4 long bolts for mounting gang.

or 78 may be used. Type 58 may also be used with the necessary change of socket and with the provision of a 2.5 volt heater supply.

The screen supply of the converter and I-F amplifier proved quite a problem. Hitherto, in a receiver of this nature, one could include a voltage divider and obtain the necessary screen voltages simply by the adjustment of a moveable clip.

The voltage divider also served as a bleed resistance and helped to stabilise the voltage during the warming-up period.

NO VOLTAGE DIVIDERS

Unfortunately, voltage dividers have become relics of history, and some other method of supplying the screen has to be adopted. Some form of voltage divider network is really a necessity when the aim is to make the circuit adaptable for a variety of valve types. A simple dropping resistor would permit too much fluctuation of voltage with different valves and perhaps with the input signal.

It is not much good specifying heavy duty wire-wound resistors, because these are now very scarce, as also are two, three, and five-watt carbon resistors. If the circuit is to be really useful, it must utilise nothing more than ordinary one-watt resistors.

After giving the matter a considerable amount of thought, we finally chose the network you see in the circuit. The screens are fed from B-plus through two 25,000 ohm resistors connected in parallel; a bleed resistor of 15,000 ohms goes between the screens and earth.

ONE-WATT RESISTORS

Each of the three resistors may be of the one-watt variety. The dissipation actually approaches one watt, but the resistors used in the original receiver seemed to be quite happy, although they were warm to the touch, as one might expect. The actual screen voltage under no-signal conditions was a little above the rated 100 volts, but this need cause no alarm.

For the second detector, a 6B6-G valve was chosen. Reasons for the choice were, firstly, that these valves are more plentiful than the diode-pentode types. Secondly, a high gain triode in this position makes for simplicity and allows the use of grid-leak bias.

Alternative valves for the 6B6-G are the old-style equivalent type 75 and the 2.5 volt equivalent. type 2A6.

In addition to these. there are a number of other high-mu triodes which would probably do just as well, although the gain might be a trifle lower. These types include the 6Q7, 6Q7-G, 6Q7-GT and 6T7-GT. The lastmentioned types were not actually tried out, but there should be no difficulty in their use.

DIODE CIRCUIT

Reference to the circuit shows that the volume control is used as the diode load. Although this arrangement aggravates any noise in the control, it has certain advantages and, in practice, there was no trace of noise with a control taken at random from a distributor's stocks.

A single .00025 mfd. condenser serves to bypass the R-F across the control,

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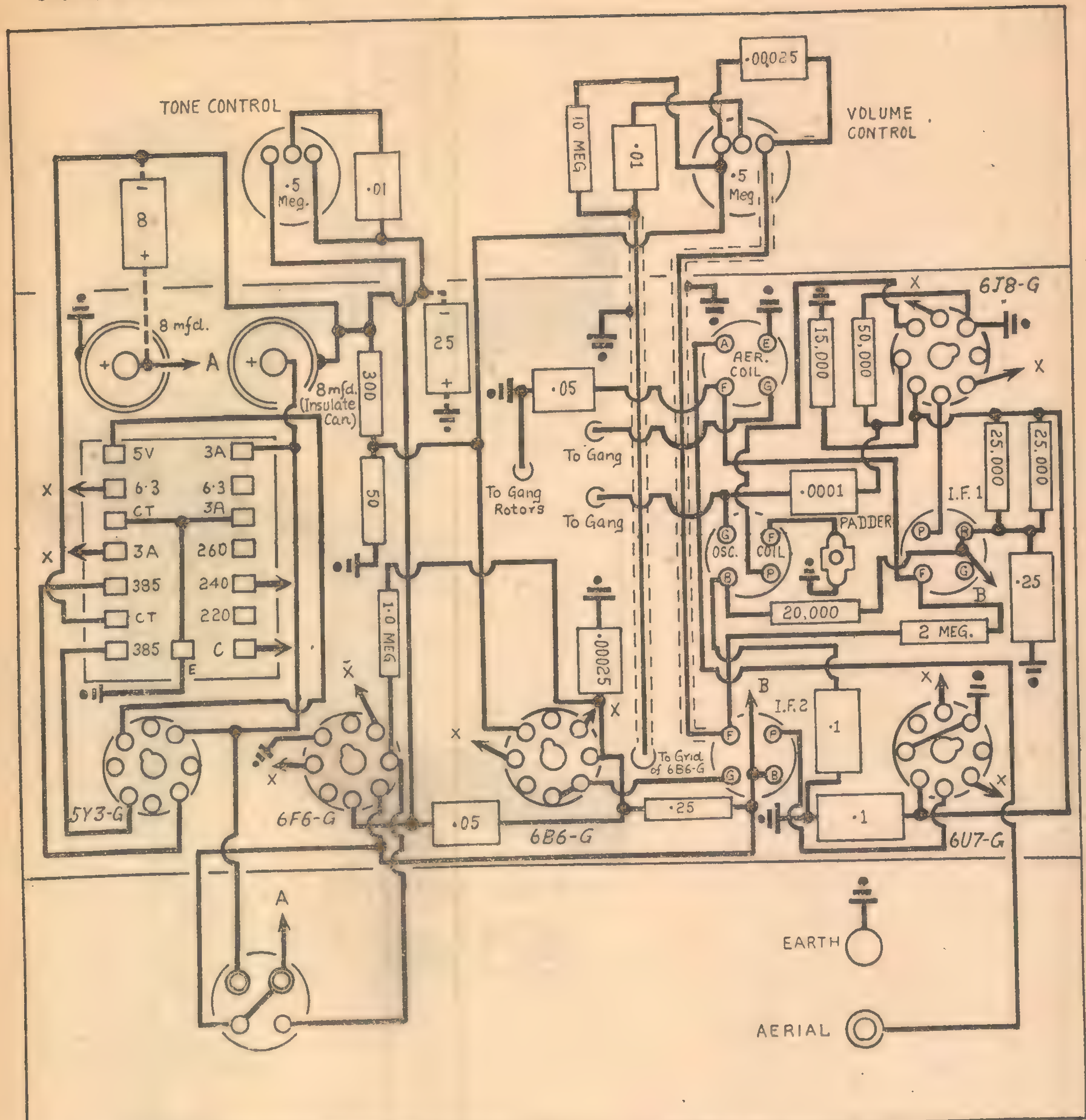


For those who are not quite able to follow the schematic circuit, here is the underneath wiring diagram. The various parts are laid out in the approximate positions they occupied in the original receiver. If old-style valves are used, due allowance will have to be made for the different valve sockets required.

and another R-F bypass is connected between the plate of the 6B6-G and the chassis.

There is a coupling condenser between the diode and the grid circuits, the grid returning to the cathode through the 10 megohm resistor. This provides what is known as grid-leak bias.

The circuit relies for its operation on the abnormally high value of the grid return resistor. The resistor may be higher than 10 megohms, if necessary but should never be less than 5 megohms. Thus far, the use of this circuit has been confined to high-mu triodes, although we have seen it used on at least one occasion with a high gain pentode voltage amplifier.

There are actually two plate load resistors for the 6B6-G. One is the normal 0.25 megohm resistor between plate and B-plus, the other being a 1.0 megohm resistor connected between the plate of the 6B6-G and the plate of the output valve. This latter resistor provides a negative feedback path and helps to improve the tonal quality of the receiver.

OUTPUT VALVE

For the output stage, the recommended valve is the 6F6-G. However, it may be directly replaced by the 6F6, the 6V6, 6V6-G, 6V6-GT, the 6K6 or the 6K6-G. With a change in socket, the valves which may be used are the 42, 41 and 2A5, the latter being a 2.5 volt type. Even the old 47 could well be pressed into service.

The grid resistor may be a simple 0.5 megohm resistor or a 0.5 megohm potentiometer, if a tone control is required. For tone control, it is only necessary to add the condenser shown dotted in the circuit.

The control simply attenuates the treble to the desired extent. The condenser used appears to be unusually large for this position in the circuit, but it must be remembered that the control is within the feedback network and has to be very severe to overcome the level-

ling effect of the negative feedback.

The bias system in the circuit warrants special mention.

At the outset, we determined to operate the output valve with more than the necessary amount of bias with the idea of reducing the current drain and of prolonging the life of both power valve and rectifier.

The other idea in mind was to reduce the current drain sufficiently to permit the use of a speaker with either a 2000 or a 2500 ohm field coil. So many people seem to have 2500 ohm speakers on hand, that there is quite a point in putting them to use.

BIAS NETWORK

Reference to the table of voltages will show that the output valve is indeed considerably overbiassed. However, you can take it from us that there is ample power output available and the tonal quality is excellent. In this, the negative feedback plays a useful part.

Some may be puzzled at the application of feedback to the plate circuit of a triode, in view of apparently contradictory statement which have been published heretofore. However, the very high plate impedance of the 6B6-G does allow quite a useful amount of feedback to be applied in the plate circuit.

But to get back to the matter of the bias: After some thought it was decided to use back-bias throughout. The immediate advantage is that the cathodes of at least three of the valves can be earthed direct, with some saving in the number of components used. Thus, the cathode of the output valve is earthed, the grid resistor returning to a point on the back-bias network.

A.V.C. RETURN

Owing to the use of simple A.V.C., the grids of the first two valves ultimately return to the cathode of the diode detector so that, to ensure the application of an initial negative bias to those grids, it is necessary to return the cathode to a point on the back-bias network instead of direct to earth.

Two standard resistors were selected for the back-bias network, which allow about the correct amount of bias for the output valve and for the converter and I-F amplifier.

The fact that the cathode is returned to a point of negative voltage does not affect the bias on the 6B6-G triode, since the grid is returned to cathode and is quite indenpendent of any connection to an external voltage.

It will be noted that the first electrolytic condenser has to be insulated from earth. If it is one of the wet can types, it will be necessary to use the insulating washers provided for the purpose.

THE POWER SUPPLY

Make sure that it is really insulated, as contact with the chassis would mean that the bias voltages would be shorted out.

With tubular electrolytic condensers, it is simply connecting one lead to the centre-tap of the high tension secondary, instead of to the chassis.

The power supply is more or less conventional, using an 80 milliamp power transformer and a 5Y3-G or 80 rectifier. These are exact electrical equivalents, the only difference being that the 80 has a 4-pin instead of an octal socket.

The first filter condenser should have a capacitance of 8 mfd. and, if at all possible, a peak voltage rating of 600 volts. The condenser on the output side of the filter may be another 8 mfd. type, although one having a larger capacitance would give a lower hum level.

If you are fussy about hum level, you may connect the extra high tension filter condenser in the position shown in the circuit. Note that it returns to the high tension centre-tap and not to the chassis.

The 25 mfd. condenser in parallel with the back-bias resistors is not absolutely essential and may often be omitted without apparent effect. To begin with, you can wire up the receiver with only the two main filter condensers, adding the other two if you feel they are warranted in your particular receiver.

RESISTOR COLOR CODE

VALUE	BODY	END	DOT
15,000 ohms	Brown	Green	Orange
20,000 ohms.	Red	Black	Orange
25,000 ohms	Red	Green	Orange
50,000 ohms.	Green	Black	Orange
.25 meg.	Red	Green	Yellow
1 meg.	Brown	Black	Green
2 meg.	Red	Black	Green
10 meg.	Brown	Black	Blue

Earlier, mention was made of the fact that the first filter condenser should be of the 600-volt type. The reason is simply that this condenser particularly is subjected to a very high voltage during the warming up period.

This has always been the case but conditions are now harder than ever, because of the scarcity of voltage dividers of heavy bleed resistors to stabilise the voltage during the warming period. The only way out of the difficulty now would be to connect a multiplicity of high resistances across the supply to obtain the required bleed current but, to say the least, such a scheme would be unduly wasteful.

POSSIBLE SAFEGUARDS

The use of an indirectly heated rectifier would certainly overcome the difficulty but such rectifiers are very scarce and will probably continue to be so for a long time to come. A directly heated power valve would also help, but, with the sole exception of the old 47, all power valves are now of the indirectly heated variety.

The use of a 600-volt electrolytic condenser in the first position is a reasonable safeguard against breakdown. If, however, you cannot obtain a 600-volt type, there is nothing else for it but to use a 500-volt condenser and hope for the best.

Some constructors favor the connection of a small torch globe in series with the connection to the high tension centre-tap as a protection for the transformer and the rectifier should the first filter condenser break down.

Another possibility is to connect the

(Continued on Next Page)

power mains to the 260 volt tap on the power transformer, instead of to the normal 240 volt tapping. While this reduces the available heater and high tension voltage, it certainly does make things easier for the condensers.

Well, so much for the electrical circuit. It now remains to consider the actual construction of the receiver.

The receiver was built up on one of the standardised 4/5 a-c broadcast receiver chassis available from most distributors. The requirements are so simple and commonplace that you should have no difficulty whatever in acquiring a suitable chassis.

CHASSIS LAYOUT

The layout of the components on the chassis is clear enough from the various photographs. You will probably find that most of the parts will fit without trouble, but a few extra holes may have to be drilled.

We found it necessary to drill extra holes for the gang condenser and to stand it up well above the chassis on four long bolts. The details of the gang mounting depend quite a lot on the type of dial used.

We chose a simple dial, but there are quite a range to choose from, even under the present conditions. The choice of dial is a matter of taste, although careful consideration has to be given to the amount of space available in the cabinet and to the style of dial face which will harmonise with the cabinet and other furnishings.

Having selected the dial, make sure just how you are going to mount it on the chassis. With some dials, you may find it necessary to make a cut out in the front of the chassis. With a drill, hacksaw, and file, this is no great hardship.

The important point is to see that the dial ultimately mounts firmly and that the gang is exactly at right angles to the front of the chassis. Having drilled the necessary holes and fitted the dial, it is a good plan to take it off again and set it aside till the rest of the construction is completed.

There are four leads to solder to the gang. Two go to the respective stator plates and two to the respective wiper contacts on the rotors. The latter have to be earthed beneath the chassis.

OPERATING VOLTAGES

THE following voltage measurements were taken with the aerial disconnected and with no signal input. The field coil resistance was 2000 ohms.

Rectifier Fil. to chassis	402 V.
B-plus supply	274 V.
6J8-G screen to chassis	116 V.
6F6-G grid bias	-22.4 V.
6B6-G cathode to chassis	-3.2 V.
Voltage across field	128 V.
Field wattage	8.1 W.
D-C current drain	64 mA.

EXTRA HOLES

You may also find that new holes have to be drilled for the valve sockets, as those for which the chassis was intended have become rather scarce. It is a good plan to search and drill all these holes extra before assembly has proceeded too far, in order to give yourself plenty of room while drilling. The padder is another component which should be checked for mounting.

Having drilled all the necessary holes, go ahead and mount the various components. Be careful to arrange the valve sockets so that the plate leads are as short as possible. Next, mount the terminals, the coils, and I-F transformers and the electrolytics, if you are fortunate enough to have secured the can types. Finally, mount the controls and the power transformer.

In mounting the components, try and get all the nuts and screws to the right tension. If you have them too loose, the components will not be firm. If you tighten them too much, you may break something. Have no fear of the power transformer bolts, as these can be tightened to the limit.

Instal earthing lugs here and there beneath the mounting nuts to act as earth points.

THE WIRING

Having completed the assembly, the next step is to get on with the wiring. We began by installing an earthed busbar down one side of the chassis between the coils and valve sockets, and then lengthwise along the chassis just inside the row of valve sockets.

A busbar, installed in this fashion, serves to link all the various earth points and makes a convenient and efficient earth return for the various wiring components. If it is kept about an eighth of an inch off the chassis, wires can be run underneath it and will be kept in place by it.

The next step is to connect up the

heaters, using leads twisted together. The rectifier socket may also be wired with twisted leads, but be careful not to twist the plate wires together too tightly.

Next, the speaker socket can be wired up and, after that, various other plate and screen leads may be put in.

Do not be over-anxious to instal the resistors and condensers. If they are put in too early, they will only hamper you.

KEEP WIRING FIRM

Make the leads short and direct, and try and arrange them in such a way that they are firm and not liable to flop about when the chassis is removed. The "hot" lead to the volume control and the grid lead of the 6B6-G should be shielded. Be careful to earth the shielding, but do not let the shielding foul any valve pins or coil connections in its journey across the chassis.

Also, be careful to keep the shielding back from the connections to the inner wire.

A very light smear of flux will help you to make good joints, but never have flux spraying or flowing all over the place. If you do slip in this regard, clean the joint immediately with a piece of rag.

Keep the soldering iron clean, and try and regulate the temperature so that it makes the solder flow readily and evenly. Use just enough solder to give the joints a smooth, slightly-rounded appearance.

BEWARE DRY JOINTS

If the solder just seems to sit up like a blob on the work, the joint is probably anything but a good one. The remedy is to scrape around the joint, add a small amount of flux and apply a fairly hot iron.

When you have installed all the leads you can, begin to wire in the resistors and condensers. By the way, do not forget to earth the cathodes of the three valves and the suppressor grid of the I.F. amplifier.

Try and mount all the small components in such a way that they are firm. Resistors may be connected either way into the circuit, as also may mica condensers. Tubular paper condensers usually have one end marked "outside foil," which should be connected to earth where the circuit demands an earth connection.

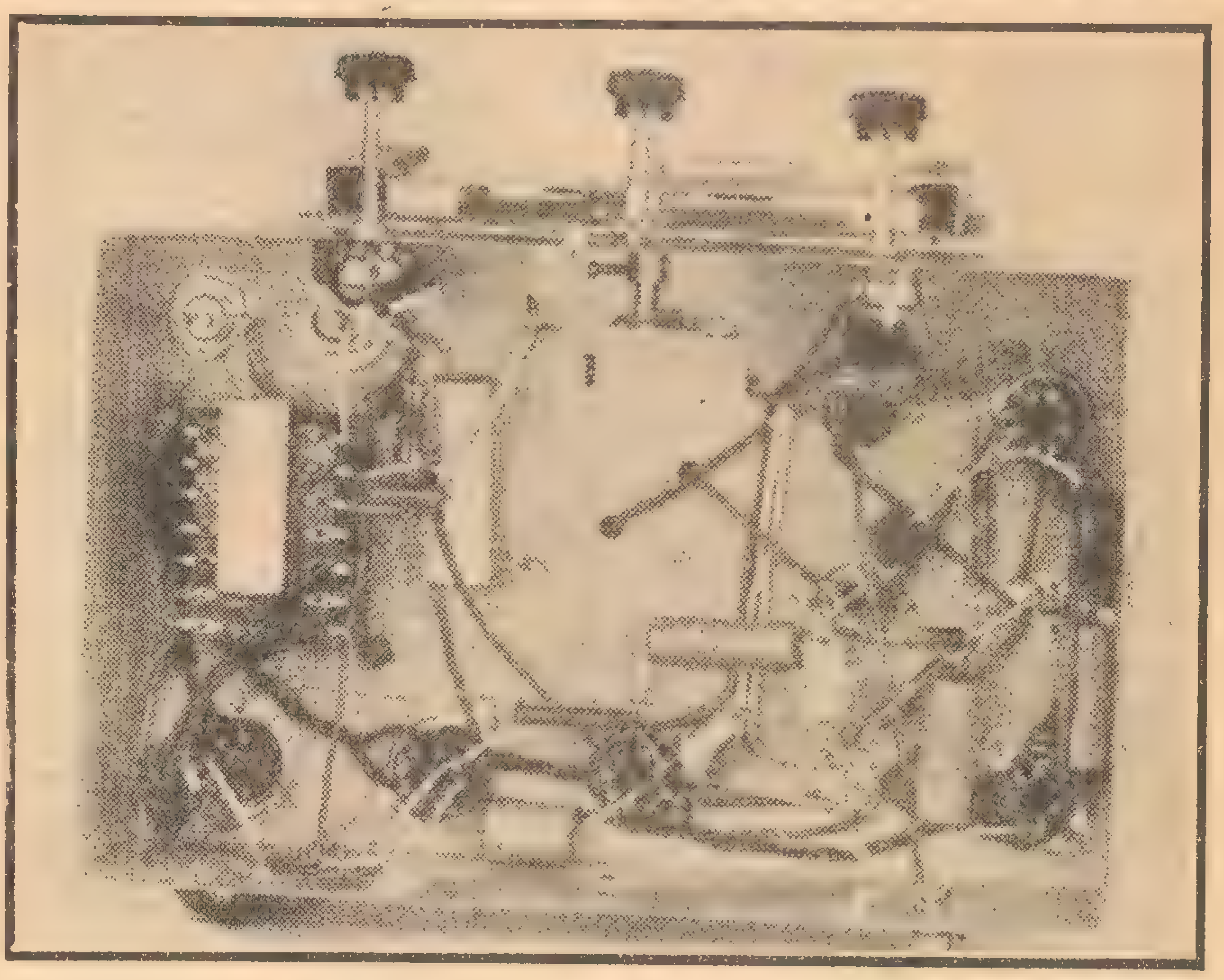
Electrolytic condensers have a very definite polarity, which must always be observed. The positive end is either marked "positive" or denoted by red wax or by a red line around the wrapping.

FITTING THE DIAL

When everything else has been completed, the dial may be fitted permanently into position. See that it is perfectly upright and that the spindle runs true with the gang spindle. Now turn both gang and dial to one extreme of their travel and tighten the grub-screws. Rotate the dial to see that it turns the gang smoothly and that the gang is driven over the full range of its travel.

Occasionally a mounting screw gets in the way, or the dial is not locked properly in place and the gang is prevented from travelling right in or right out.

AN UNDERNEATH VIEW OF THE CHASSIS



The underneath view of the chassis. Note the relative simplicity of the wiring. If you use tubular electrolytic condensers in place of the can types, it will be necessary to fit them in under the chassis. Try and arrange the wiring and the smaller components in such a way that they are quite firm.

Now proceed to wire up the dial lamps —if your dial is fitted with them. Owing to the shortage of rubber, quite a few dials seem to be going out without the lamp holders.

Next, fit the valves in their sockets, and slip the shields into place. Cut the grid leads to length and attach the grid clips. Do not take the risk of soldering to the grid clips while they are on the topcaps of the valves, no matter how convenient this may appear to be.

OPERATING VOLTAGES

THE following voltage measurements were taken with the aerial disconnected and with no signal input. The field coil resistance was 2500 ohms.

Rectifier Fil. to chassis	408 V.
B-plus supply	260 V.
6J8-G screen to chassis	110 V.
6F6-G grid bias	-20.6 V.
6B6-G cathode to chassis	-2.92 V.
Voltage across field	147.5 V.
Field wattage	8.7 W.
D-C current drain	59 mA.

Turn the receiver over again and check it lead for lead with the diagram and part for part. Check the connections to each socket and coil. If everything appears to be OK, connect up the speaker. The speaker socket is wired to conform to the conventional practice of having the little pins go to the input transformer and the large pins to the field.

Leaving the rectifier out, connect the receiver to the power. If everything is OK, you may hear a very slight buzz from the power transformer and the valves heaters will come up to a red glow.

Watching the plates carefully, plug the rectifier in. The filaments should heat and there may be, for a few seconds, the suggestion of a blue glow between the filaments and the plates. Any flashing over a permanent glow would indicate a short circuit.

If the rectifier appears to be quite happy, turn up the volume control and touch the cap of the 6B6-G with your finger. This will normally produce a loud hum and a squeal in the speaker.

Now connect an aerial and earth and see if you can tune in a station. Until the receiver is aligned, the stations may be well off calibration, but that can be corrected.

If you have kept all the leads short and direct and followed the general layout of the original chassis, you should not have any trouble with instability. The receiver may actually appear unstable at the low frequency end of the band, but this is due to the natural resonance of the aerial coil primary and should disappear when the aerial is connected.

If there should still be a trace of instability, try the effect of adding a 0.1 mfd. condenser in parallel with the existing bypass condensers and between the 6B6-G cathode and earth. The connection of a 0.1 megohm resistor in parallel with the 15,000 ohm screen bleeder will reduce the screen voltage a little and may help.

Keep the aerial terminal and the aerial lead well away from the wiring of the I-F amplifier, and shield the aerial lead for a short distance from the terminal if necessary. You will note that we made the lower terminal of the two the aerial connection.

CONSTRUCTION

The final job is to align the receiver.

If you have an oscillator, the first job is to align the I.F. transformers Remove the grid cap from the converter and connect the output of the oscillator between grid and chassis. This will remove the bias temporarily but will not matter for the short period of time concerned.

Proceed to align the trimmers or iron cores, one by one, remembering to keep the receiver volume control well up and the oscillator output well down. For some of the iron cores, you may find it necessary to use a fibre or bakelite screwdriver. which can e made up readily enough from scrap.

If you have no oscillator, leave the I.F transformers severely alone for the beginning.

TRIMMERS, PADDERS

Now reconnect the converter grid lead and tune in a station in the vicinity of 2SM, preferably a weak one. Assuming that the oscillator trimmer is at the centre of its adjustment, see if you can find a peak on the aerial trimmer.

This can often be done best in daylight hours, when there are a fewer signals to confuse one. Do not worry about the dial setting at this stage If you have an oscillator. you can use this to peak the aerial trimmer.

Now tune in a signal with the gang plates nearly in mesh. By simultaneously moving the dial and adjusting the padder, find the setting of the latter which allows the station to come in the strongest.

Now set the needle pointer so that it is pointing to the calibrated position of the station. The dial pointer may be set in this fashion for any station on the low frequency end of the band between, say, 2FC and 2CR.

Tune in a signal near 2SM and, by adjusting the oscillator trimmer, bring the station to the calibrated position on the dial. Finally, peak up the aerial trimmer. If you are fussy, you can now go back and recheck the padder, resetting the pointer if necessary at the low frequency end of the band. This will necessitate checking again the oscillator and aerial trimmers at the high frequency end. The stations in the centre of the band should track automatically, when the stations on either end have been adjusted.

ARE YOU A SUBSCRIBER?

THE last two or three issues of "Radio and Hobbies" have been sold out completely within about 10 days of being released We have received many letters from readers who have missed out on their copies and who are anxious to complete their files. Unless a few odd copies happen to be returned to us we can do nothing to help, since we simply cannot increase the number printed each month.

The only way to ensure receipt of each issue is to place a definite order or a subscription with your local newsagent. Alternatively, you may send your subscription direct to this office, at 60-70 Elizabeth-street, Sydney. Annual subscription is 6s posted, or 3s for a period of six months.

If you did not align the I-F transformers beforehand, these may be carefully checked. No matter how carefully they are aligned before leaving the factory, it is inevitable that the setting will be affected to some extent by the exterior connections.

With a pencil, record carefully the settings of the various trimmers or iron cores, whichever the case may be. Remove the aerial and very carefully tune in a signal which is weak enough to require the volume control to be turned well up to hear it.

If the signal is too strong, the A.V.C. will mask the effect of the adjustments. If you have the signal too loud, it will be difficult to note slight changes in level as you adjust the trimmers.

One by one, carefully try the effect of adjusting the trimmers, taking particular note just how far you turn them and in what direction. Slight adjustments one way or the other may bring about a marked increase in the signal level.

During these adjustments, do not touch the dial setting. If you find that you have to change the settings of the trimmers to any great extent, it would be as well to repeat the alignment process of the trimmers and padder.

After this, the receiver should be ready to fit into the cabinet. You will find that its performance is well up to the standard of any equivalent commercial receiver both as regards quality of reproduction and ability to receive stations.

That, then, is the story of the "Jeep" five valver!

FURTHER NOTES ON WINDCHARGERS

(Continued from Page 29)

Mr. Phillips, of Howqua, says that he has found that most cut-outs from cars close readily enough at an initial charging rate of 2 amps or thereabouts. However, when the generator speed gradually falls away again, the cut-outs often fail to open as cleanly as they should.

ADJUSTING CUT-OUT

As a remedy, he suggests rewinding the series coil with a greater number of turns of finer wire. There may be mechanical and electrical difficulties in this idea, but it is one of those things with which one can experiment. In any case, it is well to spend some time adjusting the spring tension and the gap spacing for the best possible results.

In making these adjustments, a good ammeter in the circuit is very helpful, if not indispensable.

It is important to note that, with the majority of cut-outs, the cover forms the earth return of the shunt winding. This would, therefore, have to be connected to the grounded side of the circuit, as shown in the accompanying diagram.

Mr. Phillips goes on to say that he much prefers the type of windcharger in which the propeller drives the generator direct, without intermediate gearing. This naturally requires that the generator be capable of delivering the necessary output at the lower speed of rotation.

REWINDING ARMATURE

In most instances, this necessitates rewinding the armature and perhaps the fields, for which about one pound of wire is required. Of course, the constructor also has to have available the necessary information as to wire gauge and the number of turns for the particular generator on hand.

Mr. Phillips suggests that it may be possible to avoid the necessity of rewinding the generator by choosing a generator which has a normal voltage rating in excess of the rating of the battery to be charged. Thus, for a 6-volt battery, a 12-volt generator might be used; similarly, a 6-volt generator might serve to charge a 2-volt accumulator.

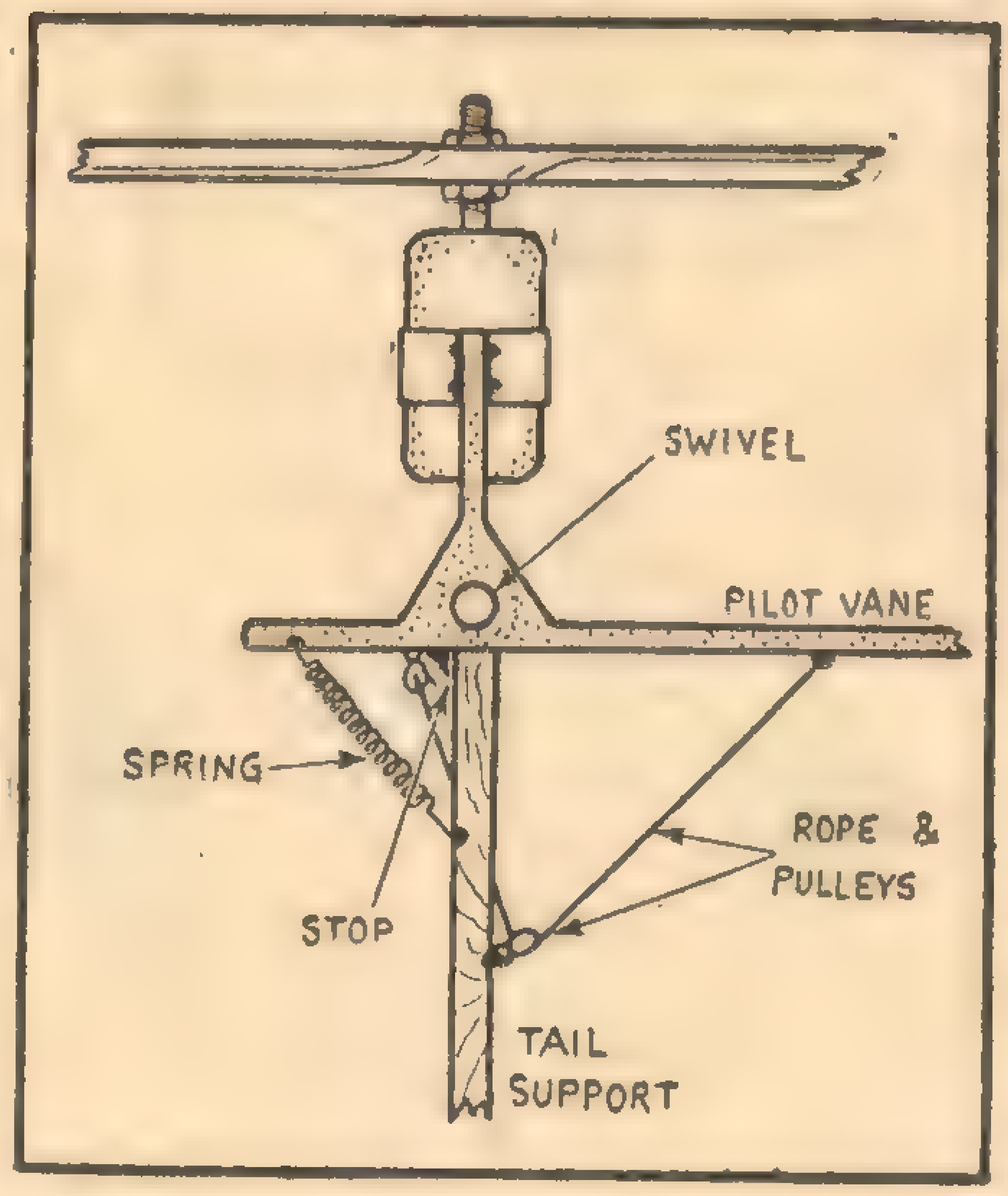
Such generators would already have an ample number of turns on the armature and the existing field windings may possibly be satisfactory if connected in parallel.

A VERY BIG SUBJECT

Naturally, these points open up quite a large field of discussion and would require thorough investigation. It would be quite impossible to give much useful information without going into another full-length article on the theory of auto generators, and the methods of rewinding them.

Mr. M. F. Forrester, of Macksville, is another who prefers direct drive. At the moment, he is occupied building a charger described in an issue of "Popular Mechanics" and utilising a rewound generator from a model T Ford.

The direct drive idea certainly has

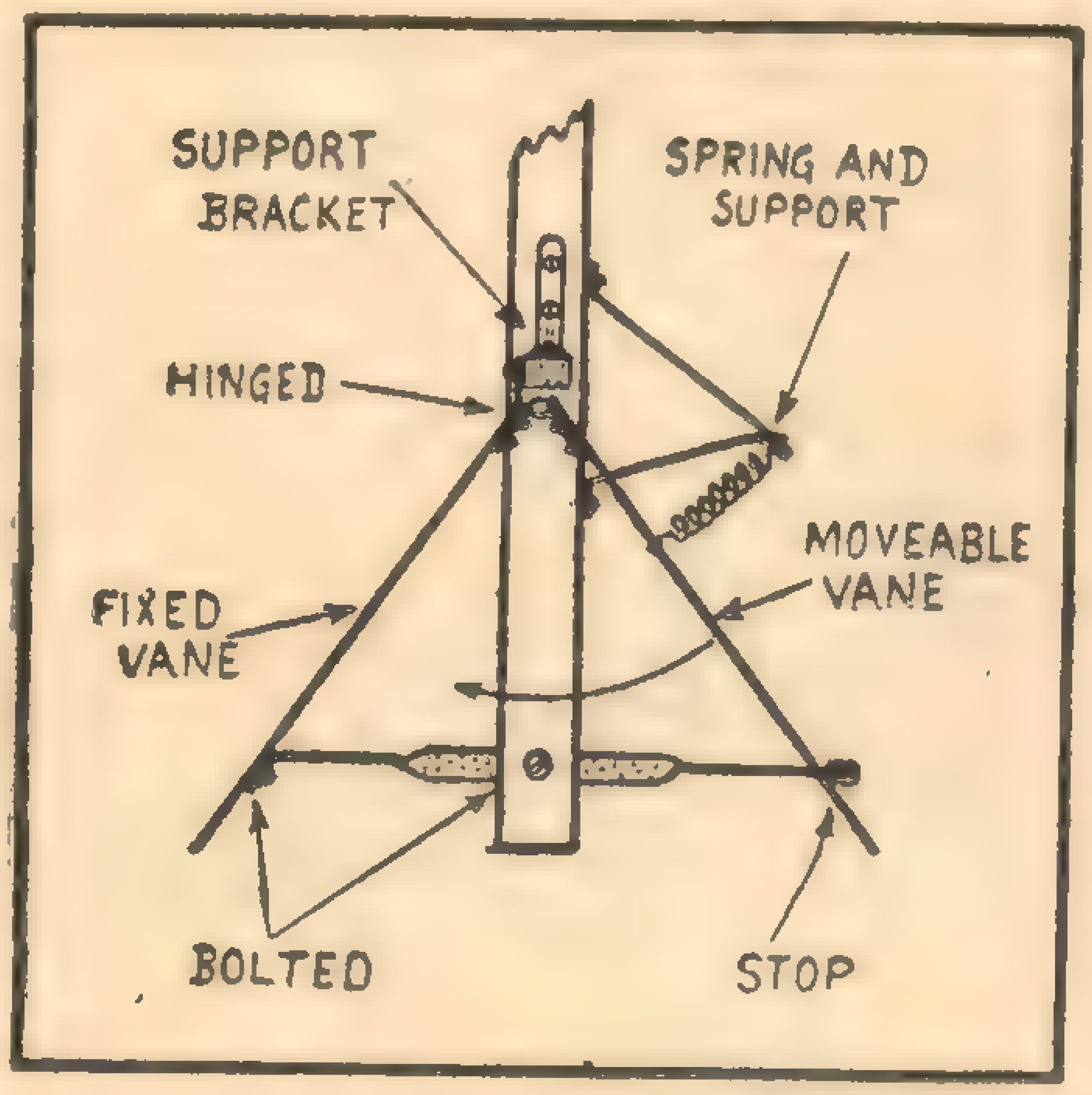


Illustrating the use of a pilot vane to limit the propeller speed in a high wind. The pilot vane is broadside on to the wind and forces the propeller back out of alignment during a heavy blow. It is not a difficult matter to arrange a system of pulleys so that the propeller may also be turned out of the wind by pulling on a rope from below.

the advantage of mechanical simplicity and avoids frictional losses in the gearing. However, it does complicate the work for the man who has no intimate knowledge of generator theory.

Another point, which would have to be watched, would be in connection with the ability of the generator bearings to withstand the load and the thrust of the propeller. In this regard a word with the local motor mechanic might be helpful.

Mr. Harrigan, of Dorrigo, says that



Those who do not care to attempt independent swivelling of the propeller and tail may like to try out this suggestion from Mr. Leeson. The tail has two fins in the form of a V, one being fixed and the other hinged. In a high wind the hinged fin is forced over against the fixed fin and the balance of the tail is upset so that the propeller is turned aside from the direct force of the wind.

he is not at all happy about the use of wood in the assembly of a windcharger. He is not alone in this opinion, as it is expressed in one or two constructional articles we have seen on the subject.

However, the fact that windchargers using wood in their construction have performed quite satisfactorily for long periods, is evidence that one can actually build up a good job with wood in the structure. Obviously, the important thing is to choose the right kind of timber in the first place and to see that it is properly protected against the ravages of the weather.

Furthermore, all metal work would have to be bolted very firmly to avoid movement and consequent enlarging of the holes through the wood.

No doubt, an all-metal structure is to be desired, but not all constructors have the necessary facilities.

LIMITING SPEED

The charger designed by Mr. Leeson and described in our last issue had no provision to limit the speed in strong wind. Mr. Leeson expressed the opinion that limiting device were all right as refinements, but he had not found them necessary to the fundamental task of charging batteries.

Other correspondents were just as emphatic that limiting devices were essential, some also advocating the incorporation of pulleys to turn the propeller of the wind altogether during violent squalls.

While it may be a tribute to some assemblies that they do not blow to pieces, in very heavy winds, it does seem a sound idea to have some means of saving the windcharger from undue mechanical stresses. Of course, the district in which the charger is set up will have a lot to do with this, as some districts are worse than others in the matter of squalls.

One fairly common arrangement for automatically limiting the speed is shown on page 29. The propeller assembly and tail vane are both swivelled independently of one another, the propeller assembly being offset to one side of the swivel.

OFFSET PROPELLER

In a moderate breeze, the propeller assembly and the tail vane are held in alignment by a suitably arrange spring. In heavy gusts, the tail remains directly into the wind but the propeller assembly is forced back against the pressure of the spring until the propeller is at an oblique angle to the direction of the wind.

The sketch is intended to do no more than convey the basic idea, but the mechanically minded handyman should have no great difficulty adapting a windcharger to the scheme. Naturally, the tension of the spring and the amount of offset are important to the proper functioning of the arrangement.

In some cases, the action may be improved by attaching a small pilot vane to the generator and broadside on to

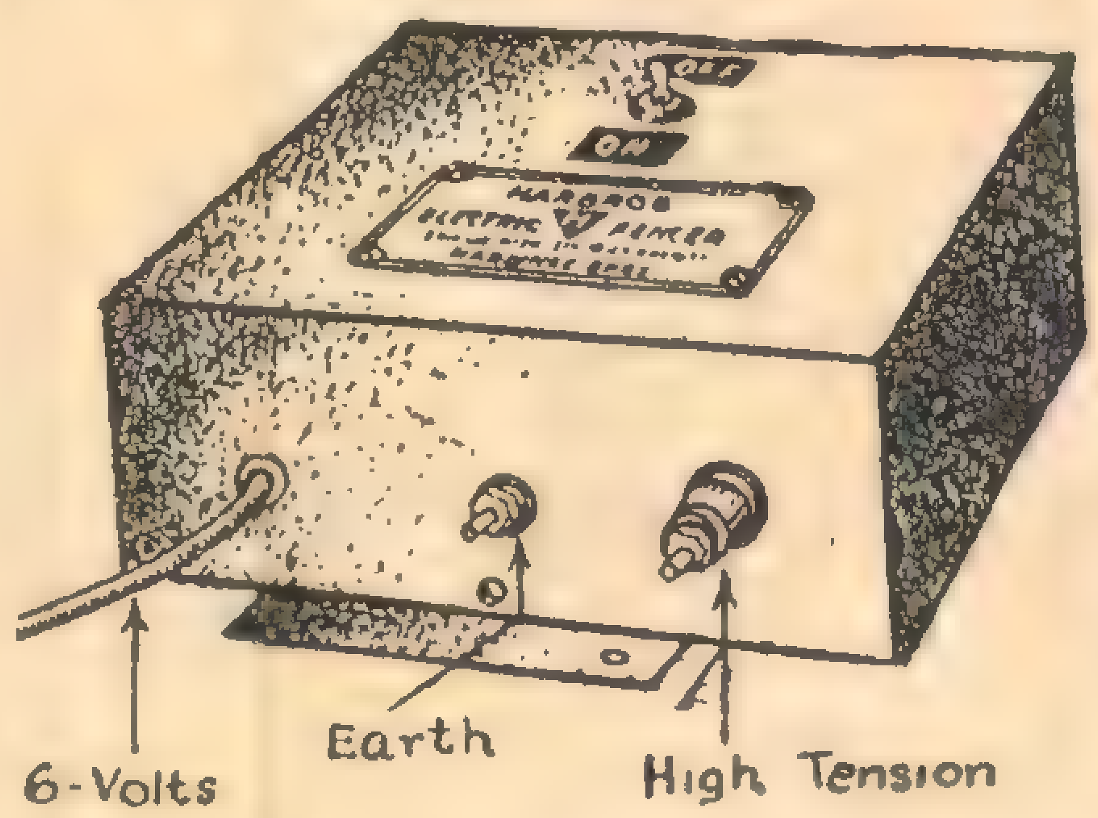
(Continued on Page 55)

TRADE NOTES AND NEW RELEASES

SCIENCE ON THE FARM

THE "HARBROS" ELECTRIC FENCE

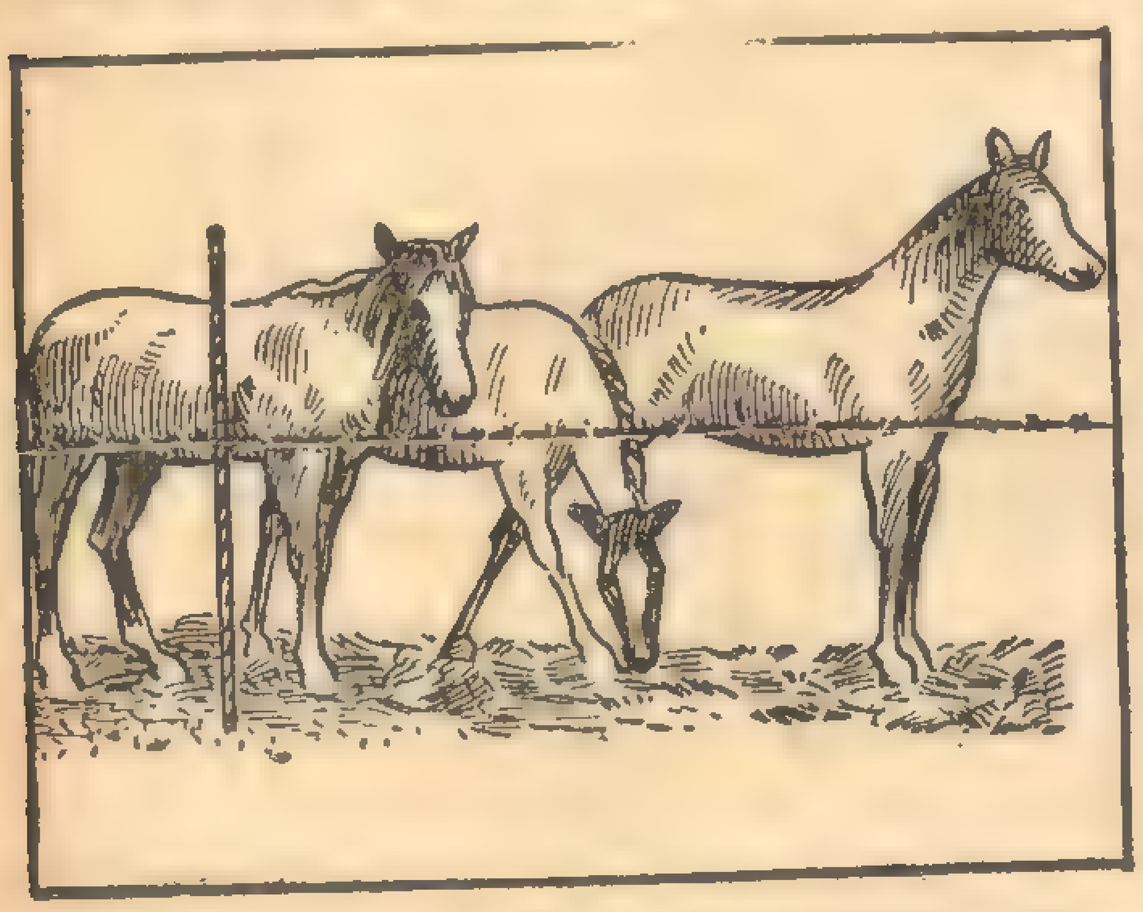
A recent circular through the post reminded us of an extremely interesting electrical device to which no reference has been made in Radio and Hobbies for some time. We refer to the so-called electric fence.



Electric fences differ from the usual variety in that animals are restrained, not by the physical barrier that the fence presents, but by the fear of contact with it.

Briefly, an electric fence consists of one or perhaps two wires strung up on light posts and insulated from earth. A device, usually operated from a storage battery, is connected to the fence and imposes upon the insulated wire a surge of high voltage every few seconds.

One side of the circuit is earthed, so that an animal standing on the ground



and contacting the fence receives an unpleasant shock. The apparatus is so designed that the shock is not physically dangerous, although it is sufficiently unpleasant as not to be forgotten easily.

The following facts and figures are taken from literature to do with the "Harbros" electric fence, distributed by Breville Radio Pty., Ltd.

The wire should be erected at two-thirds the height of the stock, two wires being used for mixed stock such as horses and sheep. New or second-hand wire may be used, barbed wire being preferable on account of the better contact possible and because it is easier to see.

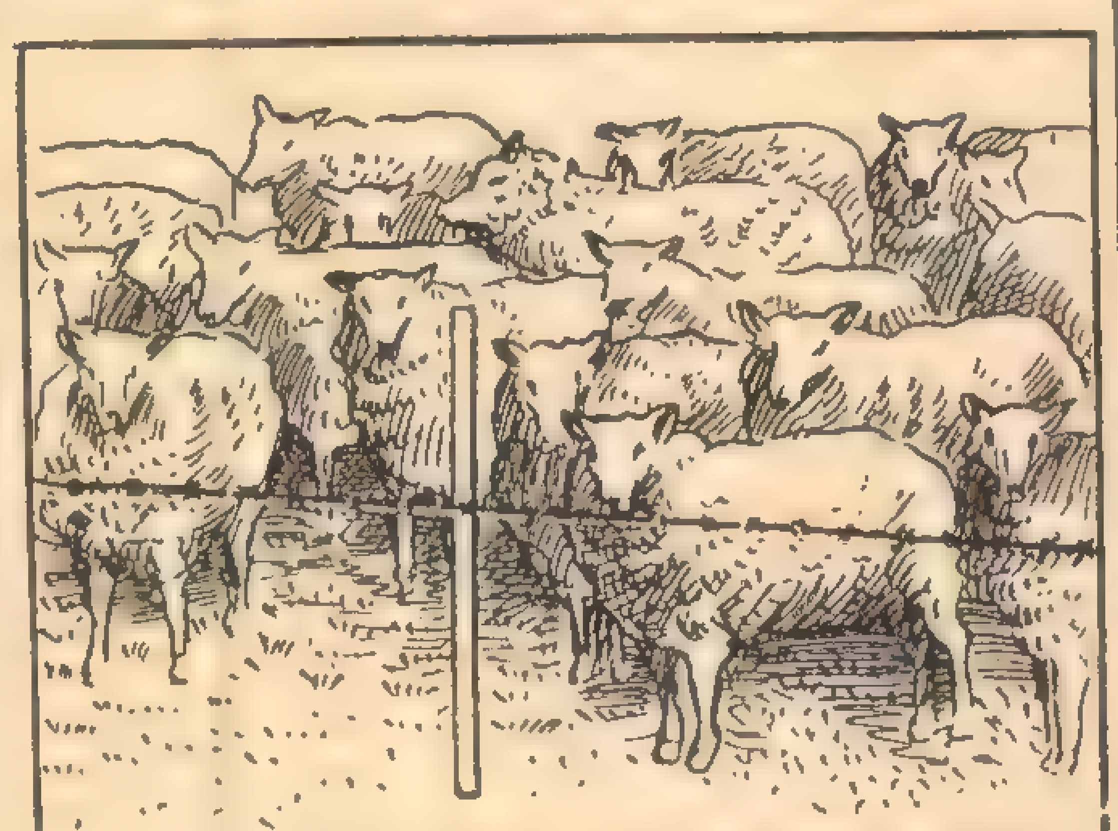
The "Harbros" unit will operate from any 6-volt storage battery or from a tapping on the home lighting plant, the current drain being extremely small. Charging is desirable every five or six weeks to prevent sulphation of the battery.

One unit will charge between 20 and 30 miles of fencing, which may be arranged in any fashion, provided the circuit is not broken. The wire should be strained and supported every 30 or 40 feet on stakes or light posts. Special insulators for attaching to the posts are available.

The unit needs to be effectively earthed, preferably to a pipe driven six or seven feet into the ground or to a tin buried about three feet down.

At the outset, the animals needs to be trained to respect the fence by bringing them slowly towards it until they make contact with the wire. One or two contacts will serve to endenger a healthy respect for the fence. After that, the animals will graze calmly nearby, but will be careful not to touch the wire.

Among the many testimonials received by the distributors is one from Mr. R. Morrison, of Pyree. Says Mr. Morrison: "I had a bull which would either jump or smash any fence. I ran a wire round his paddock about two feet in from the existing fence, and we put him in the paddock on the 23rd ultimo. He is still there!"



It is claimed that, owing to the simplicity of the arrangement, a saving of up to 80 per cent. can be effected in fencing costs. One man can easily fence 15 to 20 acres a day. The simplicity also allows the fences to be rearranged without difficulty for rotational grazing.

Wholesale distributors for the "Harbros" electric fence are Breville Radio Pty., Ltd., 67-73 Missenden-road Camperdown, NSW.

ARC Welding Plant

Australian Standard Issued

AUSTRALIAN Standard No. C.97-1942, "A.C. Electric Arc Welding Plant (Transformer Type)," has just been published by the Standards Association of Australia.

The specification was prepared in response to a request from the Electricity Supply Association of Australia, whose members were anxious to have established some definite basis for the rating of welding plant in order to enable effective control of demand and power factor, and thus to minimise system disturbances from such plant. The present specification deals only with transformer type plant. It is intended eventually to deal also with resistance welding plant, but this presents a number of additional problems.

ESSENTIAL BASIS

The essential basis for fixing the rating is contained in definitions, where the terms "rated load voltage," "maximum continuous welding current" and "test ratio" are carefully defined. Test ratios are given for non-automatic and automatic single-operator sets and for non-automatic multiple-operator sets supplying given numbers of operators per phase.

Provisions are included relating to transformers (for which BS No. 171-1936 is referred to), reactors and resistors, and also to condensers for power factor correction. The power factor of the plant is defined and a limit given. There are also clauses referring to earthing, flexible cables and electrode holders.

Inquiries relating to the above should be addressed to the Standards Association of Australia, Science House, Gloucester and Essex streets, Sydney.

PICTUREGRAM SERVICE SUSPENDED

THE picturegram service, by means of which facsimiles of photographs, prints and all kinds of documents may be transmitted telegraphically between Melbourne and Sydney was to be suspended for the duration of the war, the Postmaster-General (Senator W. P. Ashley) announced recently.

The facility had been in operation for nearly 14 years, and the maintenance of the service under present conditions represents a serious problem to the department because of the difficulty of securing replacement parts and for other reasons, the Postmaster-General said. In the circumstances, it was necessary for the service to be suspended as from August 31.

THE MONTH ON SHORT WAVES

by *Ted Whiting*

SUMMER TIME COMMENCES

DAYLIGHT RECEPTION WANING

We would remind our readers that, with the change to summer time, the reception of stations will for the most part occur at a time which is one hour later than that to which we have become accustomed for the past few months.

It will be found that many stations will be heard at a time which will be more convenient to those who are only able to put in a small amount of time at the receiver, so that this change will not be so bad after all.

Those listeners who keep a close watch on conditions will notice the changes in reception which are evident at this season of the year.

We are now experiencing a change from the excellent forenoon reception to an improvement in evening reception. This is all to the good, since there are few of us who are able to spend much time at our hobby during the day. The majority are able to listen in the evening, and will receive much more encouragement by hearing the strong signals at these times.

EUROPEANS IMPROVE

For the past few months we have been able to hear but little of the BBC and other Europeans after the close of the Pacific Service until 11 pm in some cases. We are pleased to record that it is now an easy matter to hear these stations from 9 pm, and we are sure that many listeners will take advantage of these improvements.

The Asiatics are also very strong, and are being heard on all bands from 19 metres to 49 metres in the evening. Many of these stations are to be heard using the English language in their transmissions, and are therefore easily logged and identified. News of the world can be heard also from these sources, colored, of course, by the varying shades of opinion obtaining in this world of ours.

The Americans are also heard well, and for those who can stay at the receiver until the late hours, several South Americans may be heard also at good level.

FREQUENCY CHANGES

Many stations are now likely to make an appearance on a new frequency, or yet on a new band to which we are not accustomed to hearing them. The engineers operating short wave stations are very much alive to the fact that full efficiency of transmission is largely dependent on the frequency used, and very fine signals from stations using low power are due to a careful choice of the frequency. Several changes are noted in this issue, and we have no doubt that more will be reported in the near future.

SWISS RADIO

As we suggested in the previous issue, improved reception would be made possible by the advance of the time of transmission by one hour. This has been agreed to by the Swiss authorities, and from September 1 the service will open at 4.30 pm. We feel sure that signal strength will improve as a result of this change, and it will therefore be possible to listen to the whole transmission in comfort.

FIFTY METRES AND OVER

The response for this new section has been very poor in the last month, but we hope that we will receive some more letters on this subject in the near future.

We have had one letter from Mr. Cushen, of New Zealand, in which he gives us a list of stations heard in that country recently. We give this list in the hope that some of our readers will be able to hear the signals. We believe that these stations should be heard in this country at about midnight, at least that seems to be the most logical time. Mr. Cushen has in the past had the enviable experience of hearing stations on these bands in the early afternoon.

HJEX	4865kc.	61.66m.	Bolivia.
HJCA	4845kc.	61.92m.	Bolivia.
HJDX	4795kc.	62.56m.	Bolivia.
HJCD	4840kc.	61.98m.	Bolivia.
HJCW	4945kc.	60.66m.	Bolivia.
HJAP	4930kc.	60.85m.	Bolivia.

We hope you have luck with these.

All times given in this issue are in terms of Eastern Australian Summer Time. Short-wave reports for the November issue should be posted to reach Mr. Whiting not later than Saturday, October 3rd, 1942. His address is 16 Louden-st., Five Dock, NSW.

STATION ADDRESSES

Here are a few new or at least up-to-date addresses which have been gleaned from the reports of our listeners reporting the arrival of Verifications during the past few weeks.

We hope to include more of these addresses in the future and, with that object in view, we would ask all readers who have any addresses to hand to forward them to us so that they may be published for the benefit of other readers. These will be included in each issue as received and will be acknowledged in the usual manner.

TIJMP—Apartado 849, San Jose, Costa Rica.

ZOY—PO Box 250, Accra, Gold Coast.

Ponta Delaga—Director de Posto Emissor, Ponta Delaga, Ilhas dos Acores.

CHANGE OF FREQUENCY

As we have forecast in these columns, many stations will in the future and have in the past few weeks changed the frequency of operation. The station in question at present time is that old one that many of us have tried to hear in the early morning hours when they first came on the air approximately two years ago. This one is ZNR, located at Aden, at the foot of the Red Sea. ZNR is now operating on 10,285kc., 28.88m., and is to be heard at the opening time of 3.15 am, when the station call is repeated twice, after which the news is read in Arabic. This one is being heard much better here than was the case of the old frequency," and from Mr. Walker, of WA, we hear that they are being heard there at very fine strength. We have no doubt that before long we will be receiving many reports of reception of this station.

READERS' REPORTS

The following readers have sent in reports and letters for which we are very grateful:—

R. G. Gillett, Dudley Park, SA; L. Walker, Applecross, WA; J. N. Paris, Prospect, SA; Dr. K. B. Gaden, Quilpie, Q; G. Rhodes, Canberra, ACT; R. Hallett, Enfield, NSW; A. T. Johnson, Maylands, WA; H. Perkins, Malanda, Q; E. J. Perrett, Marrickville, NSW; W. N. Tuxworth, Sarina, Q; G. Swingle, Hawthorne, Q; R. K. Clack, Home Forces; M. Morriss, Merewether, NSW; E. Jamieson, Home Foces; B. Kellaher, Newport, Vic.; S. Jones, Punchbowl, NSW; A. T. Cushen, Invercargill, NZ; W. Harvey, Dubbo, NSW; L. R. Suleau, Roseville, NSW; A. E. Moore, New Farm, Q; H. Suffolk, Summertown, SA; A. S. Condon, Laura, SA.

WHEN AND WHERE TO LISTEN

Here is a chart for quick reference, giving the call and listening times for the best shortwave stations on the air. Where the station is not receivable at good strength when it comes on the air the time is given at which reception should be satisfactory.

6 am TILL NOON

GRW.—48.86m. London. Fair signal at 7 am.

Bucharest.—32.41m. Rumania. Is heard well at 7.50 am.

MTCY.—31.41m. Hsinking. The news is read at 8.5 am.

KWU.—19.53m. San Francisco. This is a good one from 8 am.

CSW7.—30.8m. Lisbon. Can be heard well from 8.15 am.

GRY.—31.25m. London. Is good on opening at 9 am.

OIX3.—25.46m. Helsinki. A good signal at 9.15 am in news.

2RO4.—25.4m. Rome. News to USA at 11.30 am.

GRV.—24.92m. London. Excellent, 11.30 am.

GRF.—24.08m. London. Fine signal at noon.

Best reception period from 9 am till noon.

NOON TILL 6 pm

KWID.—19.62m. San Francisco. Heard well from 1 pm.

Paris.—31.51m. France. Very fine signal at 1 pm.

GRG.—25.68m. London. Still heard well till 2.30 pm.

COCQ.—33.90m. Havana. Good strength at 4 pm.

XEWW.—31.57m. Mexico. Very fine at 4.30 pm.

KGEI.—25.58m. San Francisco. This one is quite good at 5 pm.

GRW.—48.86m. London. Fine signal in Pacific Service till 6 pm.

SBP.—25.63m. Stockholm. Good strength at 5.40 pm.

TPZ.—24.76m. Algiers. Fair signal at 6 pm.

DJW.—31.09m. Berlin. Very good strength at 6 pm.

Best listening period 2.0 pm till 6 pm.

6 pm TILL MIDNIGHT

KWD.—27.68m. San Francisco. Good station from 6.30 pm.

KGEI.—31.65m. San Francisco. This one heard at good strength at 6.30 pm.

JZJ.—25.42m. Tokio. Very good signal at 8 pm news.

WGEO.—31.08m. New York. A very fine signal from 9 pm.

COCQ.—33.90m. Havana. Very good at 9 pm.

CBFY.—25.63m. Montreal. Heard very well from 10.30 pm.

Moscow.—31.43m. Russia. This one heard at good volume at 10.40 pm.

GSV.—16.84m. London. Good from 11 pm.

XGOY.—31.17m. Chungking. Great signal in news at midnight.

Best listening period from 10 pm till midnight.

NEW STATIONS OF THE MONTH

INDIA—AMERICA—RUSSIA

INDIA

THE first station on which we comment this month is a new one from India which is to be heard on 25.44 metres, which wavelength corresponds to a frequency of 11,792Kc. An Asiatic type of programme is heard in progress at 10.15 pm daily, frequent references being made to "All India Radio." The strength of this transmission is excellent at this location, and Mr. Gillett, of SA, who first brought this one to our notice, reports it at very good level.

KWD, SAN FRANCISCO

It seems that the supply of new stations in the service of the USA will never be exhausted, and by the way they rock in here and the excellence of their productions, we hope that many more will take the air in the near future.

The latest of these is KWD, whose transmitter is located at Dickson, Cal. KWD operates on a frequency of 10,840 Kc, 27.68M. The service opens at very good strength at 6.30 pm and remains so until closing at 10.30 pm.

On the several occasions on which we have heard them they have been carrying programmes of their own origination, while at other times they carry the service heard from KWID.

KGEI, SAN FRANCISCO

The transmitter which has been operating in 7250Kc. under this call has been replaced by one on 9550Kc, 31.41M. This new outlet does not give anywhere near the service to which so many of us have listened on 41.38M, and several of our reporters have termed it as woeful. However, it seems that they are putting a good signal into the southern States, and so we have hopes that it will improve in the near future. The station takes the air at from 7 pm to 3 am.

A further change was also made in as much as a further frequency has been taken in in the afternoon. KGEI now operates on 11,730Kc, 25.58M. from 3.15 pm till 6 pm, and can be heard from opening at fair strength, building up to a very good signal at about 4.15 pm.

KWU, SAN FRANCISCO

A very popular station in the morning these days is KWU, which is to be heard at from 7.30 am till 9 am daily. This station puts a very good signal at this location, and some very fine programmes are to be heard. News is read frequently, and similar productions are heard as from the other American stations heard here. This one seems to be generally heard over the country, judging by the reports we are receiving about them. Tune for this one on 15.355Kc, 19.53M.

WGL, NEW YORK

By way of a change, we find that a new station is evident from the East Coast of America. This new one, WGL, of New York, is now radiating the service which was formerly given by WDI on 5065Kc. WGL is heard at good strength on a frequency of 9750Kc, which corresponds to 30.76M. They are also heard at good level in most districts, while other reporters in the far-flung parts of the country are rather disappointed at the result of the change.

MOSCOW

A new Russian is to be heard daily in a session for French listeners opening at 2.30 pm. The announcements are all made in French, and the continuity of the service is only interrupted at 3 pm when the news is read in Spanish. The station is operated on 11,860Kc, 26.41M., and is audible at good strength.

A CHANGE IN OUR HABITS

AT this time of the year it becomes necessary for us to change our times of listening for those stations which bring us so much pleasure. With the advent of summertime we find that many stations will be heard which had faded out previous to our belated rising each morning.

On running over the bands, it is noticed that these stations are rolling in at often a strength which we never realised, which shows that it is well worth while to get to the receiver early in the morning.

Many of our reporters will, we know, be hearing stations in Africa, and we anticipate many reports of stations from this continent, which are so attractive since they are a little harder to receive.

Europeans are also in evidence at this hour, and many good programmes are to be heard, especially from the Home Service of the BBC.

For those who are in the habit of doing their listening at the dead of night it will mean staying up an hour later at night. However, a run over the bands will often reveal stations which in the past have been disregarded or which were only a weak signal in the midst of a few stronger ones.

We do, therefore, recommend a close watch over the spectrum of short-wave broadcasting, for by these means much can be done towards the promotion of international goodwill.

THIS MONTH'S VERIFICATIONS

BOLIVIA.—Our friend Mr. Cushen, of New Zealand, reports the reception of verification card from CP2. This is a very unusual station to be heard in this country, but in New Zealand it seems that things are very different from what we are accustomed. Veri's have also been received from WCRC for reception in the 6Mc band, and a nice array of booklets from PSH. Certainly a good month's work.

AZORES.—Mr. Clack has been very fortunate in receiving a novel verification from the station located at Ponta Delaga, Azores. The report for this station was sent on January 20 last, and recently he received a copy of a newspaper on the first page of which was printed in Portuguese the letter which Mr. Clack sent in. We have a copy of this letter and the article accompanying it, and as soon as we get it translated we will give our readers the opportunity of reading this novel way of getting a verification.

AFRICA.—One of our consistent reporters in the person of Mr. Perkins, of Malanda, Q., has recently received a reply to a report sent to ZRH on their transmission in the 49 metre band. The reply took the form of a letter stating that they could not send him a card. It seems that this station may have discontinued the practice of sending cards. A letter was also received from COCQ bearing the crest of the station at the head of the letter.

PERU.—Verification cards have been received by Mr. Moore, of New Farm. These cards are from WCRC, heard on the 25-metre band. The best one is from OAX1A, Chiclayo, Peru. This is an attractive card with the call letters in red. The slogan of the station also appears, "Radio Delcar." The address is Saenz-Pena No. 109, Cassilla No. 9, Chiclayo, Peru.

CUBA.—In a further letter from Mr. Cushen, he advises us that in the last few months he has received verifications from the following:—COK, HVJ, CFRX, PMH, CB1180, YV5RN, France Libre d'Orient, WLWO (25M. and 19M.), SUV, T14NRH, CJCX, WRCA (19M. and 16M.), WNBI, FZI, and several Australian stations. This is some list for any listener, and is the result of many hours at the receiver.

AMERICA.—Mr. Morris, of Merewether has received a reply from WOR in response to a report for a transmission of WJQ. The station disclaims any knowledge of WJQ, and states that they have received previous letters on this subject from Australia and New Zealand. However, they advise to stay tuned to the same frequency and "you will receive WOR." Well, we can make neither head nor tail of this, but we still hear them as WJQ. Maybe we are still right. We would add that WOR returned Mr. Morris's International Reply Coupon.

COSTA RICA.—We have heard from Mr. Condon to the effect that he has received a veri from TIJMP. This station radiates on a wavelength of 25.21M. The card is of the older type and carries the station letters in red on the front, as are also the slogan of the station, "Sistema Nacional de Radioemisoras" (National Broadcasting System). The thanks of the station are included, the whole making quite a nice effort on their behalf.

GOLD COAST.—The same listener has received a letter from ZOY, Accra, in reply to a report sent some time past. This letter states that the station is on the air from 4.30 pm to 8 pm GMT daily, except Sunday. There must be quite a few who have received letters from this one recently.

CANADA.—The usual card has been received from CBFY, which carries "Canada Calling" in red block letters at the head. This is, of course, a CBC station, and is heard well at the present time.

WITH OUR S.W. REPORTERS

MR. R. G. GILLETT, DUDLEY PARK

ONCE again we turn to the Southern State to hear something of a very active listener who is wont to turn in some very fine logs. Mr. Gillett has heard in the past most of the stations audible in this part of the world, and he keeps a very fine watch on the bands, which is very evident since, when a new station comes on the air, one of the first to report it is this same gentleman.

RECEIVER

Many of our reporters use receivers operating with a goodly number of valves, but Mr. Gillett is perfectly satisfied with his five-valve mantel model receiver of a popular make. The set tunes from 13 metres to 43 metres, and, in addition, he is able to receive the 49 metre stations by means of the use of their harmonics. This, of course, when those stations are coming in well. This receiver is very efficient, as each month we receive a log comprised of stations whose signals have been received from all parts of the world.

AERIAL SYSTEM

The aerial system in use is a very interesting one, as well as being unusual. It is in effect a series of inverted L aerials. There are five aerials cut to resonate on the various bands which are covered by the receiver, and are all slung from the same mast. A switching device is installed to enable instantaneous change from one aerial to another. It is found that at various times the performance of the wires varies, and, as a result, maximum reception is achieved at all times. We would mention at this juncture that we feel sure that any listener who is interested would be supplied with the details of construction by receipt of the usual stamp for reply, either to Mr. Gillett or direct to ourselves.

LOGGINGS

During the two years that Mr. Gillett has followed the hobby he has logged no fewer than 371 overseas stations from 62 different countries. This is no mean feature, and we have no doubt that before long the log will be into the 400 mark. Recently the interest in verification cards has become evident, and cards have been received from America, Ecuador, Canada, and Cuba. Much literature has been received from WGEO and from the American-Swedish News Exchange. In addition, Mr. Gillett informs us that he has many reports out, and some 19 were recently despatched in one week. We hope that all these bear fruit, and so form the foundation of a collection of cards which will not only be interesting, but will also represent some long hours at the receiver.

The location of the listening post is not a good one, since it is situated on a main road, together with power and telephone wires, and at the rear a railway line. The usual disadvantages of an industrial suburb are also found at the location, so it will be seen that the reception reported is a very fine achievement, speaking volumes for the efficiency of the receiver and the powers of concentration of the listener.

LAST-MINUTE NEWS

KES2

IN an air mail letter from Mr. Elsom, of WA, we learn of an American station which has been heard in that State. This one operates on 8930Kc., 33.50M., and carries most of the service heard from KWID, in the evening. The logging forwarded to us was made at 12.30 am. We have no doubt that this one is to be heard at an earlier hour, but up to the time of writing we have not been able to track them down.

WJT

Reports have come to hand concerning another new one heard on 34.09M. at 10.30 am, carrying the news. This is another one we have not heard here. We will deal with them in our next issue.

ZNR

We find on further listening that our forecast on this station, inasmuch as they would be more easily received, is rather out of order, since we find that they have decreased in strength. We hope that this is only a temporary change, as we feel sure that many would like to add them to their log.

IT is certainly fascinating to sit by a good short-wave receiver and to listen to signals from all over the world. However, quite a large number of our readers are doing precisely the same thing on the Broadcast band. Their listening is complicated by static and local interference, but they enjoy it, just the same. Turn to page 58 and read through Roy Hallett's DX notes.

OVERSEAS S.W. STATIONS NOW AUDIBLE

The list of stations shown below comprises only those which have actually been heard in this country during the past few weeks, and does not include stations which are on the air but not heard as yet in this country. A large majority should be heard on any sensitive receiver, and when a station is reported for the first time readers' names who report it are shown in brackets. At the end of each group is a list of correspondents who have sent in reports.

ENGLAND

GSA—6050kc. 49.49m. Daventry. Heard well at 6.30 am in European service and at 4 pm.

GSB—9510kc. 31.55m. This one is to be heard in African service from 6 am to 7.30 am. Also used in Pacific service from 4 pm.

GSC—9580kc. 31.32m. A very good signal in the N. American service from 9 am till 3.45 pm.

GSD—11,750kc. 25.53m. This station may be heard at almost any time of the day.

GSE—11,860kc. 25.29m. We still receive this one on rare occasions at 6 pm.

GSF—15,140kc. 19.82m. Used in the African, Pacific and Eastern services when it is invariably a good signal.

GSG—17,790kc. 16.86m. Can be heard at 11 pm. Fair signal.

GSH—21,470kc. 13.97m. This band will soon become operative.

GSI—15,260kc. 19.66m. Heard at good level in the Pacific service at 6 pm.

GSJ—21,530kc. 13.93m. Not heard at present but will be in the near future.

GSL—6110kc. 49.10m. Heard in the Pacific service at 4 pm. Good signal.

GSN—11,820kc. 25.38m. This one is used in the foreign service. Heard at 12.30 pm and at 7.30 pm.

GSO—15,180kc. 19.76m. Heard in service in the foreign language service from 11.15 pm.

GSP—15,310kc. 19.60m. Also heard in the Pacific service. Not always as good as they might be.

GST—21,550kc. 13.97m. This is the most likely of the stations on this band to be heard in the early part of the summer.

GSV—17,810kc. 16.84m. Heard in service from 11 pm.

GSW—7230kc. 41.49m. Used in the European service. Heard well at 6 pm.

GRD—15,450kc. 19.42m. Heard in the Pacific service at 7 pm. This one is also used in the African service from 3 am.

GRE—15,375kc. 19.51m. A further Eastern service station at 9.45 pm.

GRF—12,095kc. 24.80m. Heard radiating with GRV a service for Latin America from 9 am till 2 pm.

GRG—11,680kc. 25.68m. Heard at 6.30 am in the African service and from 7.45 am till 1 pm in the N. African service.

GRH—9825kc. 30.53m. A good signal in the N. American service from 11 am till 1 pm.

GRI—9415kc. 31.86m. This one has not been reported this month.

GRJ—7320kc. 41.00m. Used in the European service, when it may be heard at 7 am and 7 pm.

GRK—7185kc. 41.75m. This one is used in the Home service at 4 am and 7 pm.

GRM—7250kc. 41.38m. This one is now used in special transmissions, but has not been reported this month.

GRN—6194kc. 48.43m. Can be heard at fair strength at 6 am.

GRC—6180kc. 48.54m. Is used in the African service from 4 am.

GRP—17,890kc. 16.77m. We have not heard this one for some time, but believe they are still in service.

GRQ—18,030kc. 16.64m. The same remarks apply to this one.

GRR—6075kc. 49.38m. This Home service station is heard very well at 3 am and at 5 pm. Some good programmes are heard here.

GRS—7065kc. 42.49m. We still consider this one of the best of the Empire stations. Heard throughout the Pacific service.

GRU—9450kc. 31.75m. An African service station heard at from 2.30 am until 3 am.

GRV—12,040kc. 24.92m. This one is heard in Spanish in the forenoon in service for Latin America.

GRW—6145kc. 48.82m. Home service station. Heard well at 3 am and 5 pm.

GRX—9690kc. 30.96m. This one is easily audible in transmission for the peoples of Europe. Heard at 6 am and 6 pm.

GRY—9600kc. 31.25m. Used in both the African and N. American services at 6 am and from 7.45 am.

The following readers have reported stations in the above group: Messrs. Suleau, Perkins, Suffolk, Moore, Paris, Rhodes, Swingle.

INDIA AND ASIA

ABC.—18,007kc. 16.56m. Batavia. A good signal in the news and P.O.W. session at 1 pm, and 9 pm daily.

Voice of Batavia.—8846kc. 31.92m. Heard closing at 2.30 pm with Liberty Bell march.

VUD2.—6130kc. 48.94m. Delhi, India. Heard at midnight till 3 am. Fair strength.

VUD2.—7290kc. 41.15m. same location. This one is heard daily at 11.30 pm.

?.—11,792kc. 25.44m. This one is now being heard at good level in an Asiatic type programme at 10.30 pm.

VUD4.—11,830kc. 25.36m. Delhi. A very good signal daily at 11.30 pm.

VUD3.—15,290kc. 19.62m. Same location. Heard very well at most locations at 4 pm and in news at 1.30 pm.

VUD4.—9590kc. 31.28m. same location. An excellent signal at 10 pm using English language.

VUM2.—7270kc. 41.27m. Madras. Good listening at 2.30 am, with news being read at 2.50 am.

VUB2.—7240kc. 41.44m. Bombay. This one is also good at 11.30 pm.

VUC2.—7210kc. 41.67m. Calcutta. Again this one is heard at 11.30 pm. The same programme being radiated.

XGOY.—11,925kc. 25.14m. Chungking, China. Good signal at 7.30 pm till midnight.

XGOY.—50.50kc. 50.42m. Same location. This one is on schedule from 11.30 pm daily. News is read at 1 am.

XGOY.—9625kc. 31.17m. Same location. News is read at midnight, and may be heard at very fine strength.

XGOY.—9635kc. 31.13m. Same location. We have not heard any more of this one since they were conducting tests on this frequency.

XGOA.—9820kc. 30.86m. Same location. We hear this one with a fair signal at from 10.30 pm till 1 am.

XGOX.—15,200kc. 19.74m. Same location. This one is heard well at 8.30 pm when news is read.

XGOI.—9300kc. 32.26m. Shanghai. This one is heard at 10.30 pm. Only fair at this location.

XGOI.—9665kc. 31.04m. Same location. Can be heard in same programme as on 9300kc, but is far better signal. News in English at 11.15 pm.

XGOK.—11,650kc. 25.75m. Canton. This one has not been heard for some time at this location, and has not been reported by any of our readers.

XGRS.—11,640kc. 25.77m. Shanghai. This one may be heard daily at from 8 pm.

XPRA.—9830kc. 30.51m. Kweiyang. We hear this one very well at 10.30 pm.

XPSA.—8465kc. 35.44m. Same location. A native type of programme is radiated from this one and may be heard at 7.30 am and 10.30 pm.

XGAP.—10,270kc. 29.20m. Peking. We hear this one on opening at midnight with quite good signal.

XGAP.—6100kc. 49.18m. Same location. Can be heard at 11.30 pm.

WHO'S WHO IN SHORT-WAVE BROADCASTING

YNRS, Managua Nicaragua

Frequency: 8585kc. Wavelength: 34.95m.

Operating Schedule: 4.45 am to 6.15 am, 10.45 pm to 2.15 am.

Standard Time: 16 hours behind EST.

Distance from Sydney: 8300 miles.

Postal Address: Radio Nicaraguense, Managua, Nicaragua.

Identification Details: Announcements are preceded by use of the title of the station.

Verification Details: A card is sent out, and in addition literature is also despatched.

Radio Suisse, Switzerland

Frequency: 11,865kc. Wavelength: 25.28m.

Operating Schedule: 3.30 pm to 5 pm on Tuesday and Saturday.

Standard Time: 9 hours behind EST.

Distance from Sydney: 10,500 miles.

Postal Address: Societe Suisse de Radio Diffusion, 30, Neuengasse, Berne, Switzerland.

Identification Details: Announcements in English on Tuesday transmission, and on Saturday in German and French. In French as "Ici la Suisse."

Verification Details: There is every hope of a nice card being sent to the sender of a correct report.

FK8AA, Noumea, New Caledonia

Frequency: 6130kc. Wavelength 48.94m.

Operating Schedule: 5.30 pm to 6.30 pm.

Standard Time: 1 hour ahead of EST.

Distance from Sydney: 1400 miles.

Postal Address: FK8AA, Noumea, New Caledonia.

Identification Details: Opens with the National Anthems of France, America, and England. Male announcer in French.

Verification Details: We have seen their card in the past, but have not heard of one being received recently.

NEW STATION LOGGINGS

THE following new stations have all been definitely heard and identified at our location since our last issue. Where call letters are not as yet known, station is listed under its location.

Kc.	Metres	Call	Location
11,792	25.44	???	India
10,840	27.68	KWD	San Francisco
9550	31.41	KGEI	San Francisco
11,730	25.58	KGEI	San Francisco
15,335	19.54	KWU	San Francisco
9750	30.76	WGL	New York
11,860	26.41	—	Moscow

XLMA.—9350kc. 32.09m. Shanghai. Very poor here, but has been reported as fair from several reporters.

XMHA.—11,855kc. 25.30m. Same location. A very good signal heard at 9 pm.

XIRS.—11,890kc. 25.04m. Same location. This Italian-owned station can be heard from 11 pm daily.

XGEI.—16,092kc. 18.65m. Kuoming. This one has not been reported for some time.

FFZ.—12,060kc. 24.88m. Shanghai. As usual, this station is still spoilt by Morse. Can be heard from 9.30 pm.

MTCY.—11,775kc. 25.48m. Hsingking, Manchukuo. Heard at times at 9 pm. Signal is weaker than for some time.

MTCY.—9545kc. 31.43m. Same location. A good signal from 8 am till 9 am.

MICY.—5740kc. 52.28m. Same location. Broadcasts in English from 1 am till 2 am. Good signal.

Saigon.—11,780kc. 25.47m. This one is much weaker than formerly. Can be heard at 9 pm daily. They remain on the air till 3 am.

CR8AA.—6250kc. 48.00m. Macao, Portuguese China. This signal is a nightly one when conditions are good. Heard at about midnight.

HSP5.—11,715kc. 25.61m. Bangkok, Thailand. A lady announcer is heard from here at 11 pm.

Voice of Thailand.—7190kc. 41.72m. Same location. Heard with good signal, closes at 12.45 am.

KZRC.—6105kc. 49.14m. Cebu, Philippine Is. Is still operating daily. Can be heard at 10.30 pm.

KZRH.—11,600kc. 25.86m. Manila. "The Voice of the New Philippines." Can be heard at 7.30 pm. Is on the air till 11 pm.

KZRH.—9640kc. 31.12m. Same location. Also under Jap control and may be heard at 11. pm.

EQB.—6155kc. 47.74m. Teheran, Iran. Heard with much punch at 5.45 am.

E??.—8110kc. 36.99m. Same location. This one is heard very good in the morning at 5.45 am. French is heard from 6 am till 8 am.

XYZ.—6007kc. 49.94m. Rangoon, Burma. This one is to be heard at from 11 pm till midnight. Under Jap control, of course.

ZHJ.—6095kc. 49.21m. Penang. Also under Jap control. Heard at from 11.35 in news in English. Fair signal.

JZJ.—11,800kc. 25.42m. Tokio, Japan. This one is heard at fine strength from 8 pm. News is read at 8 pm and 11 pm.

JVW.—41.34m. Same location. This one gives us a fine signal at 7 am.

JIE2.—9695kc. 30.95m. Same location. News is heard at 10.30 pm in English. English session concluding at 11.40 pm.

JLU4.—17,795kc. 16.86m. Same location. News is read from here at 7 pm. This is a fair signal and is on the improve.

ZNR.—10,285kc. 28.88m. Aden, Arabia. A signal worth listening for these morning. Heard at 3.15 am. The signal is much improved.

Singapore Radio—12,000kc. 25m. Heard by several reporters during the past month. Is heard at midnight using English. The station closes at 12.30 am.

The following readers have reported stations in the above group:—Messrs. Condon, Suleau, Perkins, Suffolk, Moore, Gillett, Paris, Rhodes, Hallett, Johnson, Perrett, Tuxworth, Swingle, Clack, Jones.

NORTH AMERICA

WGEA.—6190kc. 48.47m. Schenectady, N.Y. This one is on schedule at 9.30 pm daily, but we have not heard them for some weeks.

WGEA.—9550kc. 31.41m. same location. Opens at 9 am and remains on the air till 4 pm. Can be heard during the late forenoon.

WGEA.—15,330kc. 19.57m. same location. News is read at 1.15 am. Good strength from this one.

WGEO.—9650kc. 31.08m. same location. Is in service to the Pacific Area from 9 am till midnight.

WNBI.—11,890kc. 25.23m. New York. Heard on Monday at 6 pm.

WNBI.—15,150kc. 19.81m. same location. This one is heard very well at 10 am daily.

WRCA.—9670kc. 31.02m. same location. A very good signal in the afternoon. Heard from 5 pm.

WCBX.—15,270kc. 19.64m. same location. German and English is used from here after midnight.

WCBX.—11,830kc. 25.36m. same location. News is heard at 11.30 pm. Also heard at 10 pm till 10.45 on closing.

WCDA.—17,830kc. 16.80m. same location. This station is to be heard carrying the news in English at midnight. Also heard very well at from 8 am till 10 am.

WCDA.—9590kc. 31.28m. same location. Has been reported on this frequency giving the news at 9.30 pm.

WLWO.—15,250kc. 19.67m. Cincinnati, Ohio. News is heard at 6 pm. A good signal from here at 1 am.

WLWO.—11,710kc. 25.62m. same location. Heard well at 10 am daily.

WLWO.—9590kc. 31.28m. same location. Very fine signal on opening at 11 am. This is exceptionally good in the northern parts of the country.

WBOS.—11,870kc. 25.27m. Boston, Mass. Can be heard in parallel with WNBI at 9.30 am.

WBOS.—15,210kc. 19.72m. same location. Heard in relay with WRCA at 1 am in news cast.

WRUL.—11,790kc. 25.45m. same location. News is read at 7.30 am, station ultimately closes at 9.30 a.m.

WRUW.—9700kc. 30.93m. same location. Very good on opening at 7.50 am.

WRUW.—11,730kc. 25.58m. same location. Yet another good station at 10 am.

WRUW.—15,350kc. 19.54m. same location. Is quite good at this location at 1.15 am.

WCW.—15,850kc. 18.90m. New York. Is on the air from 6 am till 10 am. News read at 9 am.

WJQ.—10,010kc. 29.97m. same location. Opens at 9 am, but reaches maximum strength at about 9.30 pm.

WDJ.—7556kc. 39.70m. same location. Now on the air from 6.45 pm to 9 pm. Is rather patchy.

WGL.—9750kc. 30.76m. same location. Opens at 6.45 pm and closes at 9 pm, news being heard at 8 pm. Italian, Portuguese, and German are used in addition to English.

WOK.—10,555kc. 28.42m. same location. This station is used occasionally to radiate news commentaries and special broadcasts.

KGEI.—15,330kc. 19.57m. San Francisco. Can be heard from 1 pm. Reaches fair strength by 3 pm.

KGEI.—11,730kc. 25.57m. same location. Is now on the air from 3.15 pm till 6 pm.

KGEI.—9550kc. 31.41m. same location. Not anywhere as good as they used to be on their old frequency. Is radiating from 7 pm till 3 am.

KEZ.—10,400kc. 28.85m. same location. Relays KWID from 4.30 pm. Fine signal when free of Morse interference.

KET.—9480kc. 31.65m. same location. Relays KWID till 8 pm, then carries a programme of its own. This schedule is frequently varied.

KWID.—15,290kc. 19.62m. same location. This is one of the loudest signals on the air on any band. Can be heard from noon till 6 pm.

KWID.—9570kc. 31.35m. same location. Also a very loud signal. Heard from 6 pm till 11.30 pm daily.

KWD.—10,840kc. 27.68m. Dickson, Cal. Another whose signal is very good. They open at 6.30 pm and often relay KWID till closing at 10.30 pm.

KWU.—15,355kc. 19.54m. San Francisco. Heard from 7.30 pm till 9 am. This one is best heard at 8 am.

CBFY.—11,705kc. 25.63m. Montreal, Canada. Can now be heard from 10.30 pm until 1 am.

CFRX.—6070kc. 49.42m. Toronto. Heard at fair strength from 10 pm till midnight. Best at 11.30 pm.

CJCX.—6020kc. 49.83m. Sydney, NS. Can be heard at from 11.30 pm. Fades soon after midnight.

CBRX.—6160kc. 48.70m. Vancouver, BC. This one is heard on opening at 1.30 am. News at 2 am and the station fades out at 2.45 am.

VONH.—5970kc. 50.25m. St. Johns, Newfoundland. Can be just heard here on opening at 11.35 pm.

XEXA.—6170kc. 48.62m. Mexico City. Heard on occasions at midnight.

XEWW.—9503kc. 31.57m. same location. This one is heard well at 5 pm.

XEQQ.—9680kc. 30.99m. same location. A good signal from 4 pm till closing at 4.25 pm. This one is sometimes heard at 1 am.

KEFT.—9550kc. 31.40m. Veracruz. Can be heard just prior to closing at 5 pm.

The following readers have reported stations in the above group: Messrs. Condon, Harvey, Suleau, Perkins, Suffolk, Moore, Gaden, Gillett, Walker, Paris, Hallett, Johnson, Perrett, Tuxworth, Swingle, Clack, Kellahar, Oushen.

CENTRAL AMERICA AND WEST INDIES

HP5A—11,700kc. 25.64m. Panama City. We can hear this station at good level at 9 am and midnight.

HP5G—11,780kc. 25.47m. Same location. Can be heard well on opening at midnight.

HP5J—9607kc. 31.23m. Same location. Also audible at 11 pm.

HH3W—10,130km. 29.62m. Port au Prince, Haiti. Can be heard at times at 7 am.

HI2G—9295kc. 32.28m. Cuidad Trujillo, Dominican Republic. Opens at fair strength at 8.15 am and can be heard till 9 am.

TIEP—6692kc. 44.01m. San Jose, Costa Rica. This one is audible at from 10.45 pm. Good volume.

TIEMC—11,900kc. 25.21m. Same location. A fair signal from 11 pm till 1 am.

TIFG—9620kc. 31.19m. Same location. A fine signal from 11 pm. This is one of the best from this part of the world at this location.

TILS—6165kc. 48.66m. Same location. Can be heard well at 4 pm on Sunday.

TI4NRH—9740kc. 30.80m. Heredia. A good signal from 3 pm till 4 pm on Sunday. May be also heard at 10 pm daily.

TGWA—9685kc. 30.98m. Guatemala City, Guatemala. Many listeners are hearing this one from 2 pm. The station closes at 3 pm daily, excepting Sunday, when they are on the air till 5 pm. Good signal.

TGWA—15,170kc. 19.78m. Same location. Can only be heard at 8.30 am on Monday morning. Fair strength.

YNRS—8585kc. 34.95m. Managua, Nicaragua. Pleased to say that many of our readers are now hearing this one. Is to be heard at 11 pm with fair signal.

COBC—9695kc. 30.94m. Havana, Cuba. To be heard well at 9 am and better at 4 pm.

COBC—9365kc. 32.05m. Same location. May also be heard at the same times with similar results.

COCQ—8850kc. 33.90m. Same location. This one is very versatile in that they are on the air as far as we are concerned at 8 am, 5 pm, and 11 pm.

COCO—8700kc. 34.48m. Same location. Heard in English transmission at 11 pm daily.

COCX—9270kc. 32.36m. Same location. Heard at good strength at 9 am and at midnight. Fair signal in both sessions.

COCW—6330kc. 47.39m. Same location. Heard well on opening at 11 pm.

COCH—9435kc. 31.80m. Same location. Can be heard at 9 am with good signal.

COCM—9830kc. 30.51m. Same location. Heard well at 11 pm. This is quite a good signal.

COCY—9246kc. 32.43m. Same location. May be heard at 8 am at quite good level.

COCY—11,745kc. 25.55m. Same location. This station is heard at very good strength at from 3.30 pm to 4.45 pm. This transmission is in English.

COK—11,620kc. 25.93m. Same location. Heard at 9 am and 2.30 pm.

COHI—6455kc. 46.48m. Santa Clara. Can be heard at 11 pm with fair signal, which fades out by midnight.

The following readers reported stations in the above group: Messrs. Condon, Perkins, Moore, Gillett, Walker, Swingle, Cushen.

SOUTH AMERICA

HCQRX.—5972kc. 50.23m. Quito, Ecuador. Heard opening at 10.45 pm, and is also heard at 9 am on Monday only.

HCJB.—12,460kc. 24.08m. Same location. This one is also heard on Monday morning only at 8.30 am. Also heard at 11 pm daily.

HJCD.—6160kc. 48.70m. Bogota, Colombia. This one is heard in NZ at 1.30 pm. Hardly likely to be heard here at this time.

HJCF.—6240kc. 48.07m. Same location. This one is heard at 12.20 pm in NZ, so the same remarks apply.

HJCX.—6018kc. 49.85m. Same location. Heard frequently at 11 pm on opening.

CB960.—9600kc. 31.25m. Santiago, Chile. A good signal at 4.15 pm on Sunday.

CB970.—9735kc. 30.82m. Valparaiso, Chile. This Chilean is audible at 10.30 pm daily.

CB1170.—11,700kc. 25.64m. Same location. Heard well from 2 pm till 3.30 pm, when the station closes.

CB1180.—11,975kc. 25.05m. Same location. A fair signal at 10.30 pm daily.

OAX1A.—6290kc. 47.69m. Chicaylo, Peru. Yet another one which is heard at 2 pm in NZ.

OAX4J.—9340kc. 31.12m. Lima, Peru. This one is to be heard at 8 am till 9 am, and at 3 pm on Sunday, and at midnight daily. Best time for listening is in the afternoon.

OAX4G.—6190kc. 48.47m. Same location. Heard at 3.30 pm on Sunday.

OAX5C.—9540kc. 31.45m. Same location. Yet another one to be picked up on Sunday afternoon. The time is 4 pm.

CXA8.—9640kc. 31.12m. Colonia, Uruguay. Fair at 7 am daily and at 5 pm on Sunday afternoon.

PSH.—10,220kc. 29.35m. Rio de Janeiro, Brazil. The only time this one is operating when conditions are suitable for us is at 10 am on Saturday. The signal is a weak one, but is readable.

PSF.—14,690kc. 20.42m. Same location. Heard same time as sister station.

PRE9.—6105kc. 49.14m. Fortazela. This one opens at 8 am with quite a good signal.

LSX.—10,357kc. 28.98m. Buenos Aires, Argentina. This one is also only heard at 10 am Saturday. The signal is weak.

LRX.—9662kc. 31.06m. Same location. The same remarks apply.

The following readers reported stations in the above group:—Perkins, Suffolk, Moore, Walker, Cushen.

AFRICA

ZOY.—6002kc. 49.98m. Accra, Gold Coast. This one has not been heard here for some weeks, but should be heard at 6 am with fair signal.

ZRK.—6097kc. 49.20m. Capetown, SA. Heard at 7 45 am just prior to closing.

ZRH.—6007kc. 4995m. Johannesburg. This one is audible at 7 am. Closes following the news at 7.30 am.

ZNB.—5900kc. 50.85m. Mafeking. Also heard at the same time.

ZRO.—9755kc. 30.75m. Durban. Unlikely to be heard this side of the Western border.

?—6160kc. 40.70m. This unidentified African is heard at from 1 am till 2 am. Fair signal.

SUX.—7865kc. 38.15m. Cairo, Egypt. An Arabic service is heard at 7 am.

SUP2.—6320kc. 47.47m. Same location. Heard at quite good level at from 3.30 am till 4.30 am.

Radio Cairo.—5980kc. 50.17m. Same location. Heard at 7 am. This one uses plenty of English.

Radio Tananarive.—6063kc. 49.48m. Madagascar. Has not been reported but we hear them at 1.30 am till 3 am.

CR7AA.—6300kc. 49.71m. Luanda Angola, P. West Africa. Heard from 8 to 9 am, 12.30 pm to 3 pm and 8 pm to midnight.

CR7AB.—3490kc. 85.92m. Same location. The same schedule applies.

CR7BD.—15,250kc. 19.66m. Same location. This one also runs on the same schedule.

CR7BE.—9840kc. 30.49m. Same location. This one can be heard giving news in English at 6 30 pm. The station closes at 7.30 pm.

CR6RA.—9470kc. 31.68m. Same location. Operates from 6.30 am until closing at 8 am.

FZI.—11,990kc 25.06m. Brazzaville, French E. Africa. This is a strong station heard at 6 am and 4.30 pm. News in English at both times.

OPM.—10,140kc 29.59m. Leopoldville, Belgian Congo. Congo Belge is heard from 6 am till closing at 6.30 am.

VQ7LO.—6060kc. 49.50m. Nairobi, Kenya. Is on schedule at from 3.30 am until 5.45 am. The signal is not too strong at this time of the year in this part of Australia.

Nairobi.—10,345kc. 29.0m. We have had no further reports of this station, which is possibly being heard in WA.

TPZ.—12,120kc. 24.75m. Algiers, Algeria. A good station which may be heard at 8 am and 6.45 pm.

TPZ2.—8960kc. 33.48. Same location. This one relays TPZ Is heard at good volume.

CNR.—8035kc 37.34m Rabat, Morocco. Heard using French at 7 am. Is audible until 8.30 am. Fair signal.

FGA.—9410kc. 31.88m. Dakar, Senegal. This station is heard periodically at about 6.15 am

The following readers have reported stations in the above group: Messrs. Condon, Perkins, Walker.

AUSTRALIA AND OCEANIA

VLR.—9580kc. 31.32m. Melbourne. National programme. 6.45 pm to 11.30 pm. Closes at 11 pm Sunday.

VLR3.—11,880kc. 25.25m. National programme. Noon to 6 15 pm daily, 12.50 pm to 6.15 pm Sunday

VLR8.—11.760kc. 25.51m. National programme 6.30 am to 10.15 am daily, 6.45 am to 12.45 pm Sunday.

VLG2.—9540kc. 31.45m. To Eastern USA, 9.25 pm to 10.10 pm. 11.15 am to 12.55 pm to S.E. Asia.

VLG3.—11,710kc. 25.62m. Transmission to Tahiti in French at 3.55 pm to 4.30 pm.

VLG6.—15,230kc. 19.69m. 2.25 pm to 3.10 pm to Western States of USA; 6.15 pm to 6.30 pm to New Guinea (in Japanese).

VLG7.—15 160kc. 19.79m. National programme. 6.30 am to 8.10 am, noon to 2 pm, 7 pm to 7.18 pm; Sunday, 6.45 am to 8 am, noon to 2 pm, 7 pm to 7.18 pm.

VLQ.—9580kc. 31.32m. Sydney. To New Caledonia at 6.25 pm to 7.25 pm. Transmission in French.

VLQ2.—11,870kc. 25.27m. To Western States of USA, 1 am to 1.45 am. To S.E. Asia, 8.40 pm to 9.15 pm.

VLQ4.—7220kc. 41.55m. To North America at 12.25 am to 1.10 am. In French at 6.50 pm to New Caledonia.

VLQ6.—9580kc. 31.31m. Service to England from 4.55 pm to 5.25 pm.

VLW.—9680kc. 30.98m. Perth. Used to carry National programme from 9 pm to 11.15 pm. To S.E. Asia from 11.15 pm to 12.55 am.

VLW3.—11,830kc. 25.36m. Good signal from 8 am till 11.45 am.

FK8AA.—6130kc. 48.94m. Noumea, New Caledonia. This one is now to be heard from 5.30 pm till 6.25 pm. The signal is fair, but will improve.

The following readers have reported stations in the above group: Messrs. Harvey, Gillett, Paris.

MISCELLANEOUS

OIXI.—6120kc. 49.02m. Lahti, Finland. Heard at 2 am daily.

OIX2.—9500kc. 31.58m. same location. An equally good signal at 6.30 am daily.

OIX3.—11,870kc. 25.47m. same location. This one is very good at 2.30 pm in relay of OIX2.

HAT4.—9119kc. 32.90m. Budapest, Hungary. This one can be heard from 10.10 am. The signal fades out by 11 am.

Radio Suisse.—11,820kc. 25.28m. Berne, Switzerland. Heard from 4.45 pm till 6.15 pm on Tuesday and Saturday.

HER3.—6165kc. 48.66m. Schwarzenberg. Heard from 7 am to 8 am. No English is heard from this one.

HER5.—11,865kc. 25.28m. same location. This one can be heard at midnight on Sunday.

HVJ.—5972kc. 50.23m. Vatican City. Heard in service to England. News is read at 6.15 am. The signal is a good one.

HVJ.—6005kc 49 96m. same location This one is used in relay with transmitter on 5972kc. This one is the weaker of the two.

HVJ.—9660kc. 31.06m. same location. A further transmitter which is heard at fair level at 3 am.

HVJ —11,750kc. 25 55m. same location. Heard daily in P O War Service.

CSW6.—11,040kc. 27.17m. Lisbon, Portugal. Can be heard from 5 am till 8.30 am. This one is at very good strength.

CSW7.—9740kc 30 80m. same location. Opens at 7.15 am at very good strength and is heard until 9 30 am

Emissora Nacional.—7305kc. 31.07m. Ponta Delaga, Azores A good catch which is to be heard at 7 am till 8 am.

TAP.—9465kc. 31 70m. Ankara, Turkey. Always a fairly good signal using English at 6.15 am.

TAQ.—15,195kc. 19.74m. same location. This is a good signal at most times and is heard these days at 11 30 pm.

YUB.—6100kc. 49.18m. Belgrade, Yugoslavia. Can be heard from 6.30 am with weak signal, using French.

SBP.—11,705kc. 25.63m. Motala, Sweden. Heard at very fine strength at noon.

SBU.—9530kc. 31.46m This outlet is heard at 5 pm. Very good signal.

SBO.—6065kc. 49.46m. same location. This outlet has neither been heard here nor reported for some weeks.

LKQ.—11,735kc. 25 57m. Oslo, Norway. Another Scandinavian to be heard this time at 4 pm.

PCJ.—9590kc. 31.28m. Huizen, Holland. Has not been heard this month.

Paris.—6200kc. 48.39m. France. This one is to be heard at 6.30 am.

Paris.—9520kc. 31.50m. same location. Is on the air at from 6 pm daily. Very fine signal.

Paris.—11,880kc. 25.25m. same location. Heard at about 6.45 am daily. Good signal.

Paris.—11 845kc. 25.53m. same location. Another outlet which is heard at 6.45 pm.

Paris.—17.850kc. 16.80m same location. Will be heard again at 11 pm soon. This transmission is in English.

Moscow.—15,230kc. 19.70m. Russia. A good signal at 10 am till 11 am. Very good transmission.

Moscow.—12,060kc. 24.88m. Heard well in service in English at 11.45 pm.

Moscow.—11 660kc. 26.41m. News in Spanish is read at 3 pm. The transmission opens at 2.30 pm in French.

Moscow.—10,040kc. 29.88m. Another English transmission heard at 12.30 am.

Moscow.—7625kc. 39.21m. This outlet is heard well at 8 am daily.

Moscow.—9566kc. 31.36m. A very fine transmission is heard from this one at 9.45 pm. News is read at 11 pm.

Kuibyshev.—8047kc. 37.28m. News in English is read at 6.30 am by lady announcer.

Kuibyshev.—9520kc. 31.51m. Heard calling America for relays of news commentaries.

Kuibyshev.—6115kc. 49.08m. This outlet also takes part in the above transmission.

2RO3.—9630kc. 31.15m. Rome, Italy. Heard with good signal at 8 am and 4 pm daily

2RO4.—11,810kc. 25.40m. same location. This transmitter is audible at almost every hour of the day.

2RO6.—15,300kc. 19.61m. same location. Can be heard at 6 pm and at 1 am.

2RO8.—17,820kc. 16.84m. same location. This one will be in the limelight very soon.

2RO9.—9670kc. 31.02m. same location. Heard at terrific strength at 3 pm daily.

2RO11.—7220kc. 41.55m. same location. A very good outlet, which is heard best at 7 am. This one opens at 5.40 am.

2RO15.—11,760kc. 25.51m. same location. Another very good signal at 5 am.

2RO18.—9760kc. 30.74m. same location. Heard well at 10 am.

2RO20.—17,820kc 16.87m. same location. This one is to be heard from approx. 11 am Will improve as the summer approaches.

? —10,330kc. 29.04m. Same location. This one is good signal at 8 am daily.

? —6300kc. 47.60m. Same location. A very fine signal at 7.45 am.

DJA.—9550kc. 31.38m. Berlin. Heard in good style from 4 pm. English used.

DJB.—15,200kc. 19 74m. Can be heard well using English at 10 am and at 2 pm. This one is also used at 11.30 pm.

DJC.—6020kc. 49 83m. A good one at 7 am.

DJD.—11,770kc. 25 49m. Very good signal at 10 am and 6 pm.

DJE.—17,760kc 16.89m. This one is to be heard at 11 pm with an excellent signal.

DJH.—17,840kc 16 81m. Can be heard even now, but will be better as time goes on.

INTERFERENCE IN CAR RADIOS

Mr. L. B. GRAHAM,
Principal of the A.R. COLLEGE.

In dealing with car radio receivers, one comes up against many problems not encountered in ordinary service work. Perhaps the greatest problem is the elimination of interference due to the electrical circuits and the mechanical characteristics of the car. The installation and servicing of car receivers is quite an art in itself. The following hints should prove useful.

THE satisfactory reception of radio programmes on a car radio receiver is always a difficult problem. In the first case it must be remembered that the aerial system possible in a car is poor, even at its best, and that reception conditions are constantly changing as the car travels along a road. Trees, hills and steel buildings deflect the radio fields and make reception difficult.

SIGNAL STRENGTH

A system of automatic sensitivity control is employed in all modern car radio receivers to help compensate for the abovementioned changing conditions. When the receiver is being operated close to strong stations its sensitivity is automatically reduced to a minimum, and any electrical disturbances created by the car's electrical system do not cause any appreciable interference.

However, as one travels away from these strong stations, the signal becomes weaker, and the sensitivity of the receiver gradually becomes greater. The consequent result is that, unless special precautions are taken, the local interference will override the signals.

The obvious place to look for the cause of such interference is in the ignition system of the car. This system consists of a high tension coil, an interruptor and the HT distributing arrangements. It operates from either a six or twelve volt battery, depending on the make of car. The circuit arrangement of such a system may be seen in Fig. 2, which shows the complete electrical system of a car.

THE INTERRUPTOR

Between the battery and the primary of the ignition coil is connected the interruptor, which is operated mechanically by the engine of the car. This interruptor is commonly called the "Make and Break," as it makes the circuit and then breaks it, so that the voltage is induced into the secondary of the coil.

This voltage, owing to the large number of turns on the secondary compared with the primary turns, is very high, and is passed through a HT distributor which is operated by the same mechanism as the interruptor. The distributor directs the high voltage to the correct spark plug, so that the proper firing sequence takes place.

As the primary circuit is made and broken, current flows and ceases in the wiring from the battery to the coil, producing magnetic fields which rise and fall around all of these wires; also, as this wiring has some d-c resistance, there will be slight changes in potential between parts of this circuit.

BATTERY CONNECTION

Therefore, unless there is some means of shielding against these fields, and some smoothing out of the sudden voltage changes, interference from this source will be conveyed into the receiver.

By connecting the receiver to the low voltage system as near as possible to the battery, and by shielding the battery lead right from the receiver to the battery, trouble from this source can be minimised.

Sometimes, however, a 0.5 mfd. condenser or possibly a 500 mfd. electrolytic condenser is required from plus to minus on the battery wiring to overcome this trouble. Many receivers have these condensers built in, making such extra parts unnecessary.

SECONDARY CIRCUIT

When the breaker gap opens, a high voltage is induced in the secondary of the HT coil, and, at the same instant, the distributor arm connects this voltage to one particular spark plug. The gas between the gap in the spark plug ionizes or breaks down, and the high-voltage spark jumps across it.

Looking at the coil in Fig. 1 it may be seen that one end of the secondary goes to the spark plug, and the other to the battery circuit, and thence to the metal chassis of the car. Across the breaker contacts on the battery circuit is connected a condenser which increases the intensity of the spark, and also serves to reduce sparking on the breaker contacts.

This condenser, together with the inductance and the distributed capacity in the coil and wiring, forms an oscillatory circuit, which operates in a similar manner to the old spark transmitters. These, by the way, are now banned, due to the multiplicity of frequencies which they produce.

INTERFERENCE

Since the spark plugs fire in rapid succession, many of these oscillatory discharges occur each second. The radiations will cover a very wide range of frequencies, and will be picked up by the aerial and wiring of the receiver, regardless of the frequency to which the receiver is tuned.

As a matter of fact, these frequencies may range from audio to high radio frequencies.

One method of reducing such interference is by completely shielding the whole HT system. This is actually carried out in aircraft radio installations. However, this is not a practical method of prevention on a motor car engine, as generally it would cost too much and render service operations to the engine difficult.

The only remaining means of minimising the interference is to suppress

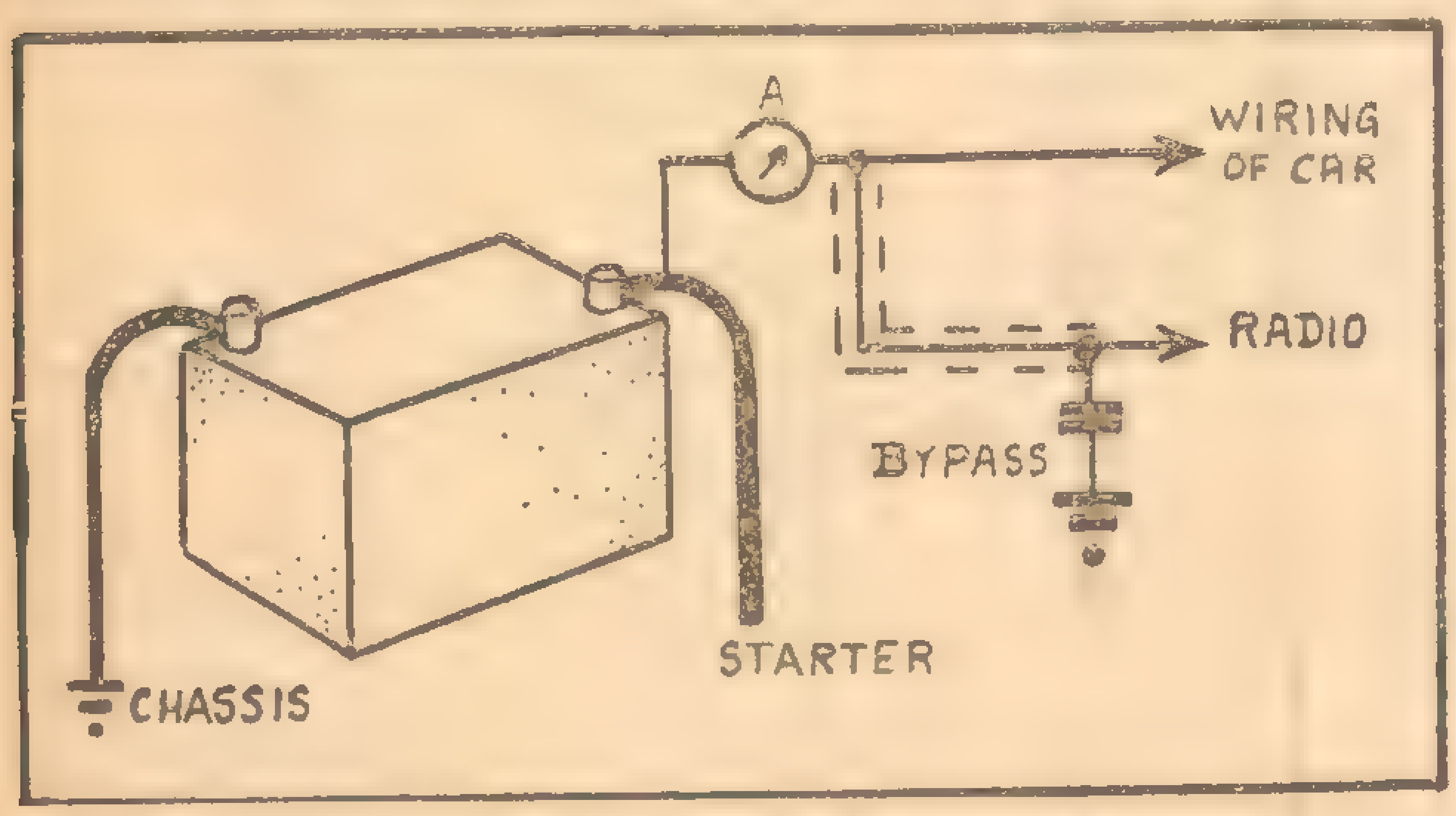


Figure 1. When installing a car radio, it is often helpful to take the supply from a point as near as possible to the terminal of the battery. This avoids long lengths of wiring common to the receiver and the electrical circuits of the car. The lead may also be shielded and bypassed to the chassis.

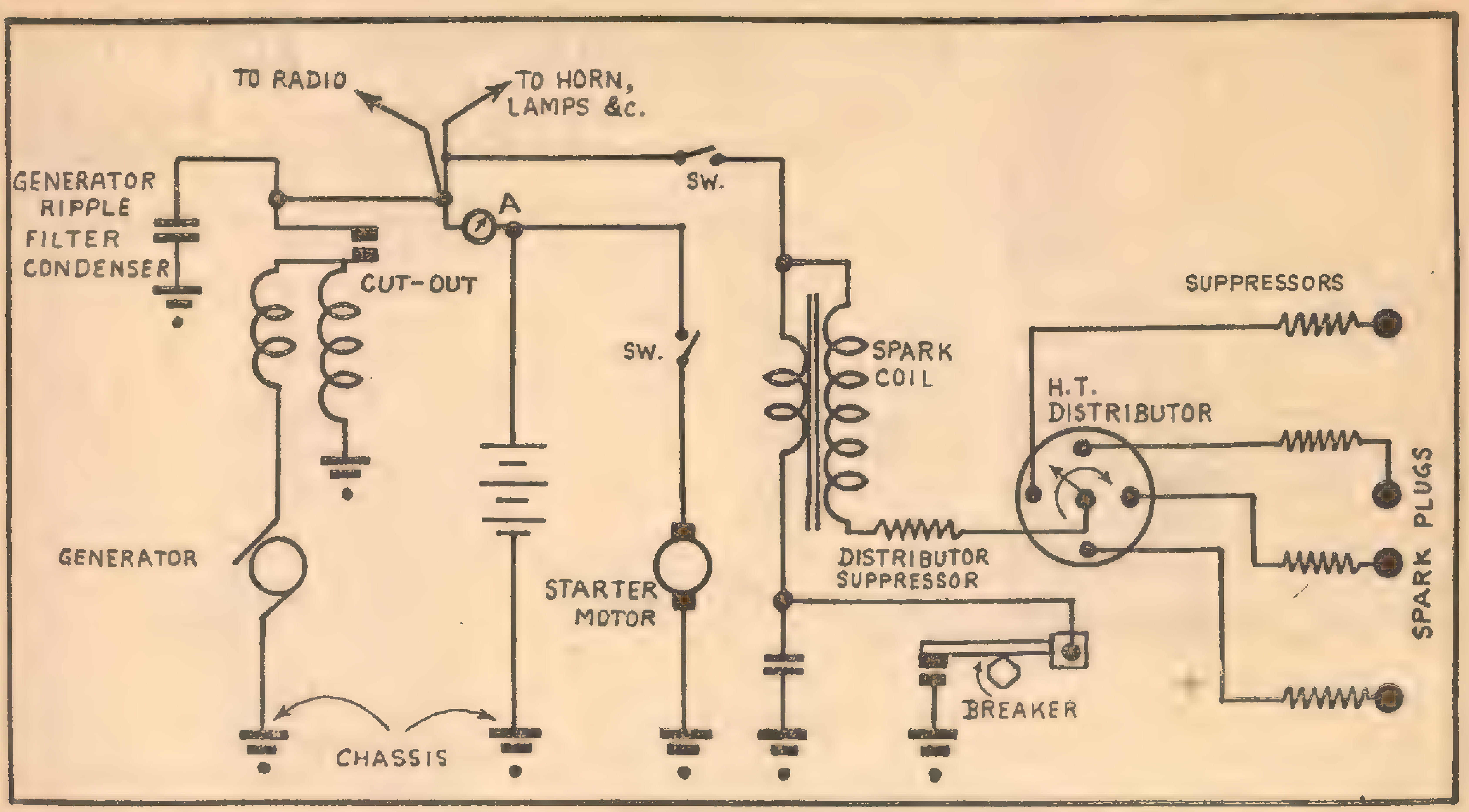


Figure 2. Here is a typical circuit diagram for a motor car ignition system. As pointed out in the article, interference may result from small potential changes and magnetic fields to do with the primary circuit. It may also be due to damped oscillations in the secondary circuit, covering a wide range of frequencies and radiated by the wiring.

the distributing radiations at their source. Then, providing that the receiver is well shielded, and that the aerial is in such a position that the weak radiations which remain cannot induce any appreciable voltage in it, satisfactory reception may be obtained.

This method is employed in practically all modern car radio installations. Since oscillation will only occur if the total resistance in the circuit is kept fairly low, the inclusion of extra resistance in the form of a suppressor resistance will reduce the strength of the oscillations, and possibly stop them altogether.

SUPPRESSORS

The resistance must not, however, be high enough to reduce the spark so that the car engine does not function properly.

Many modern cars do not require any great amount of suppression, as the all steel body construction provides an effective shielding, and also care has been taken in the electrical wiring with this in mind.

Usually, one suppressor resistor of about 5000 ohms connected between the spark coil and the distributor is sufficient to reduce the strength of the oscillatory discharges, so that they do not cause any trouble.

Sometimes, however, suppressors are needed on all spark plugs, as well as in the position first mentioned. These suppressor resistors would all have a resistance of approximately 10,000 ohms.

When HT interference is reduced sufficiently, other forms of interference will probably show up, one of the worst offenders being the generator.

The generator causes interference for two main reasons; firstly, its output is pulsating, and secondly, sparking occurs at its brushes. The first and obvious thing to do is to attempt to reduce the sparking at the brushes.

The commutator should be cleaned with fine sandpaper (never use emery, it is a conductor and particles remaining would cause trouble), and the mica should be cut down below the level of the copper, so that it does not tend to lift the brushes.

When the generator has been used for some time, it may be necessary to have the commutator trued up, as wear and oscillation of the brushes may have made it slightly oval. It is also necessary to make certain that the brushes are in good order, and rest firmly against the commutator.

The current ripple of the generator may easily be suppressed by connecting a condenser of about 1 mfd. from the lead which comes from the cut-out to the metal frame of the generator.

Generator trouble is quite easily distinguished, as it produces a whirring or whining sound from the speaker, which rises and falls in pitch as the engine speed changes.

The windscreen wipers and horn motor may be treated in a similar manner as the generator, if they should cause excessive interference. Usually a condenser, connected across the brushes, cures the trouble in such units.

SPECIAL CONDENSERS

Condensers used on ignition and generator system must be of a special type. They must be non-inductive, and must be able to withstand the high temperatures which exist around the engine; their construction must be such that will allow them to withstand the mechanical vibration to which they will be subjected without the leads breaking off.

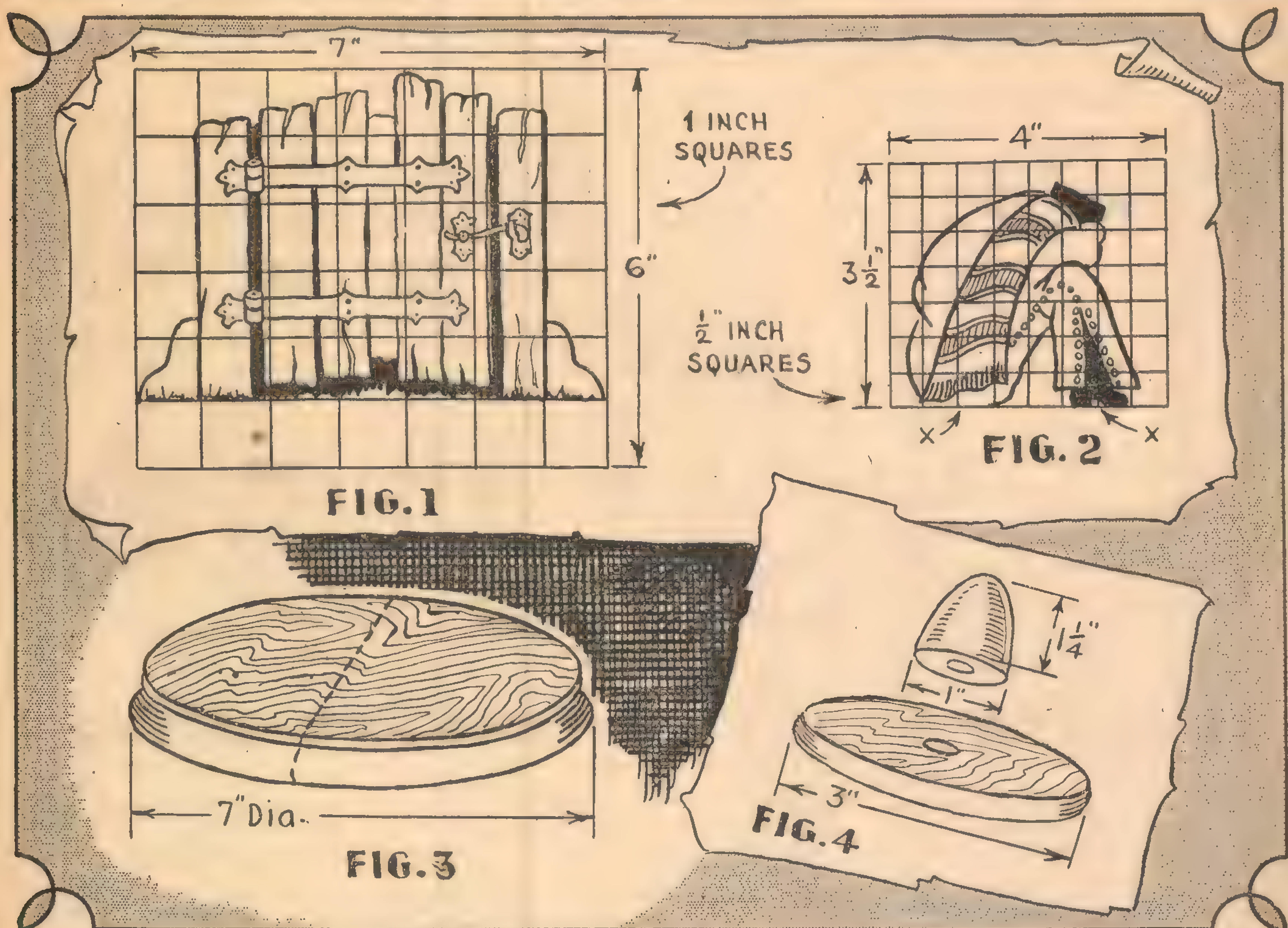
Another form of interference sometimes met with, and one which only occurs when travelling along the road, is wheel noise. This is distinguishable as an intermittent scraping and crackling sound from the speaker.

This trouble is caused by the static-electricity generated by the wind friction on the wheels, a charge which, by virtue of the poor electrical connection of the wheels to the metal work of the car, is independent to that normally produced on the body of the car. The grease on the bearings of the wheel axle tends partially to insulate the wheels, and some means of perfect insulation or permanent connection must be provided.

The latter is most easily arranged as a spiral spring with its base on the fixed bearing housing; the small end pressing on the wheel cap will make a fairly permanent connection.

(Continued on Page 56)

A SUGGESTION FOR A XMAS PRESENT—



With the aid of these plans, the average handyman should have no difficulity in making up an attractive set of book-ends. The finished articles are seen in the photograph on the opposite page. Be particularly careful with the sanding and painting, because a smooth, glossy finish is essential if the articles are to have a workmanlike appearance.

Most people can make good use of a pair of book-ends. Books leaning wearily against one end of the book shelf or lying haphazardly on top of the side table look ever so much better if arranged in a symmetrical manner and held upright by two book-ends. Little touches of neatness in the home help to make life more bearable under the present trying conditions.

CHRISTMAS will soon be upon us, and a set of book-ends will make a much appreciated present. The design given here is particularly colorful and attractive and will harmonise with almost any setting. What is more important, its execution will prove no great task for the average handyman.

First obtain a piece of nicely veneered five-plywood about 7in. wide and 12in. long. On this carefully mark out the two rustic gates.

The easiest method of doing this is to obtain a piece of white paper, marking on it a rectangle 7in. x 6in., and dividing it into 1in. squares. Then, by referring to Fig. 1 in the drawing, copy the outline of the gate and its fittings on to your paper.

Now lay the paper on the plywood, placing a piece of carbon paper between the two, and trace the design on to the wood. Repeat the process, and you will have the two gates outlined.

by **W. G. Nichols**

Cut around the outline with a fret-saw or jig-saw, and sand the edges until they are perfectly smooth. Put in the details of the gates with black paint and, when thoroughly dry, give the wood a coat of good varnish on back, front, and edges.

The next step is to make the two bases. This is done by cutting a 7in. circle of five-plywood and then cutting it through the centre, so that you have two semi-circles measuring 7in. across the flat sides.

Sandpaper the edges, rounding the top one slightly; dust the wood and then give it two coats of black lacquer.

The two figures of the Mexican peons are cut out of five-plywood in the same manner as the gates; the details may be obtained from Fig. 2 in the drawing.

After being sanded, they can be colored brightly. In the original, the scarf was painted white with black and red bands and a black fringe; the shirt bright yellow, and the trousers red, with

A PAIR OF MEXICAN PEON BOOK ENDS

black centre section and yellow dots. The design should be repeated on both sides.

The hats are the next problem. If possible, obtain an empty spool, such as used for holding the wire for radio coils. Cut the spool in two, and drive a piece of suitable dowel down the central hole, allowing about ½in. to project at the rim end.

Failing a spool, the hat can be made from flat stock and 1½in. dowel to the details given in Fig. 4. In the original, the rim of the hat was painted black, and the crown yellow, but any bright colors will suffice.

When the paint is thoroughly dry, drill a hole in the top of each peon. The dowel should fit into this tightly, holding the hats firmly in place.

With glue and very fine nails fasten the peons to the top of the base, and the gates to the flat edges of it.

Next glue a piece of flannel to the under-section of the two bases, so that they will not scratch polished furniture.

If care has been given to the finish of your book-ends, you will find you have quite a professional-looking job.

FURTHER NOTES ON WINDCHARGERS

(Continued from Page 43)

the wind, in order to cause the propeller to be deflected more readily.

The arrangement of the independent swivelling and the alignment spring presents a problem—but not an insuperable one. One constructor made use of a pair of discarded piston rods, the "big end" bearings swivelling on a central bar and the rest of the assembly being bolted to the protruding arms.

A somewhat similar scheme also employs independent swivelling of the propeller assembly but relies on the action of a small pilot vane to pull the propeller around out of the wind, when it becomes too boisterous.

The scheme is illustrated in the accompanying sketch. With this arrangement, it is a simple matter to add a rope and a system of pulleys to pull the propeller around permanently to render the charger inoperative.

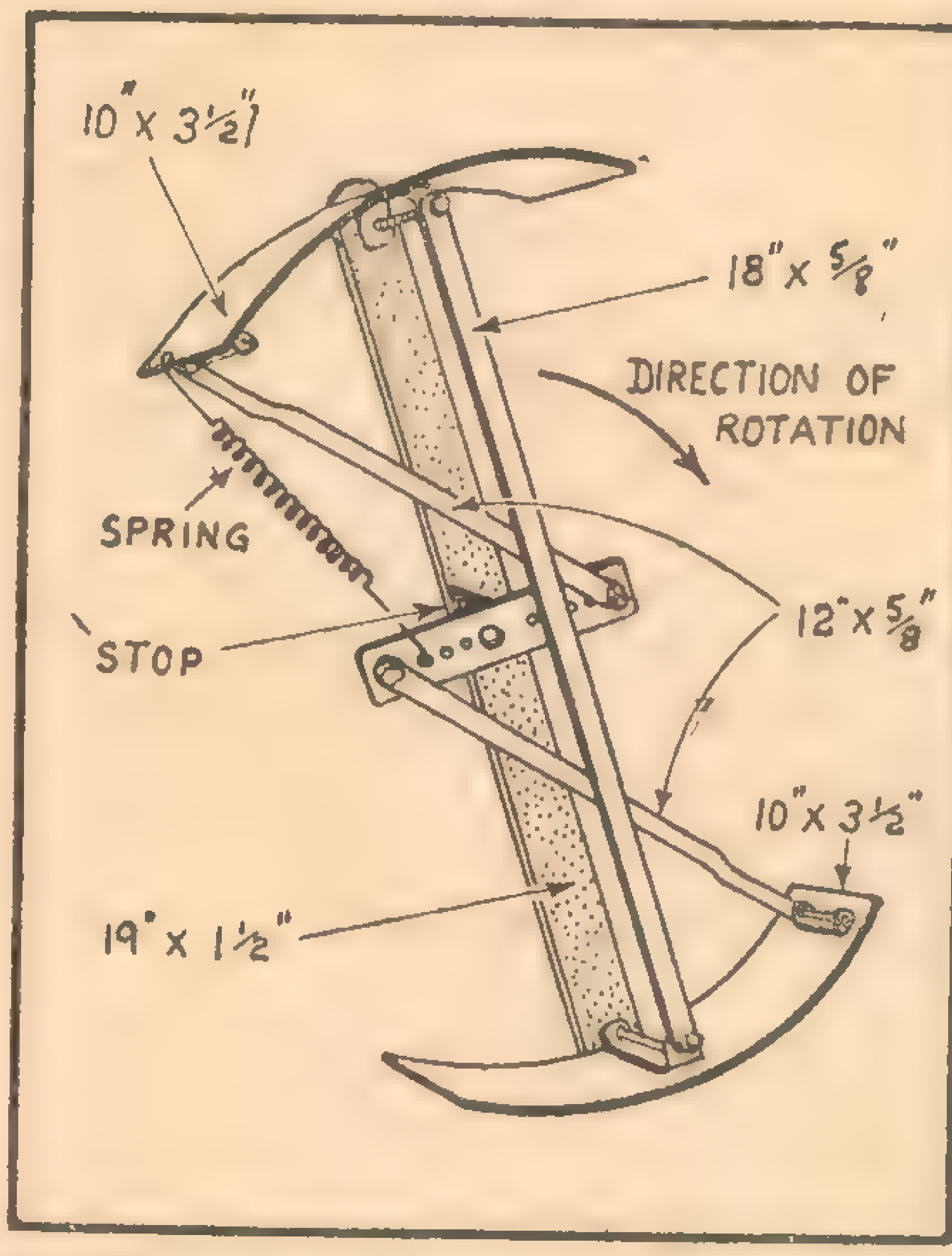
ANOTHER SUGGESTION

The sketch represents a direct drive generator, but there is no insuperable reason why the same idea could not be added to a windcharger using a system of gears mounted on a platform.

From Mr. Leeson comes a third suggestion which may function reasonably well, although it would not appear to be as effective as either of the other schemes.

Instead of a single tail fin, the suggestion is to use two fins arranged in the form of a V with the sharp edge facing into the wind. The fins may be at an angle of between 60 and 90 degrees with respect to each other.

One fin would be a fixture, the other being hinged at the sharp end of the V and held in place at the other end by means of a suitable spring.



A drawing of a centrifugal governor copied from an overseas magazine. The heavy bar at the back is bolted to the propeller spindle at right angles to the propeller blades. The transfer bar is also centred on the propeller spindle, but must be free to move.

In a moderate wind, the tail vanes would retain their normal V relationship, holding the propeller directly into the wind. In a strong wind, the pressure of the air will tend to close the V, thereby turning the propeller out of the wind.

Mr. Leeson says that, as yet, he has had no opportunity to try the scheme, and merely puts it forward as a suggestion.

In our last article, mention was made of a centrifugal governor for direct attachment to the propeller hub. The commercial windcharger illustrated on page 20 had such a governor attached.

A reader was kind enough to send in a magazine clipping showing the details of a centrifugal governor and the illustration is reproduced herewith.

The two blades on the governor should have a curvature corresponding to the circumference of a circle centred on the propeller hub and of radius equal to the distance from the hub to the point of support.

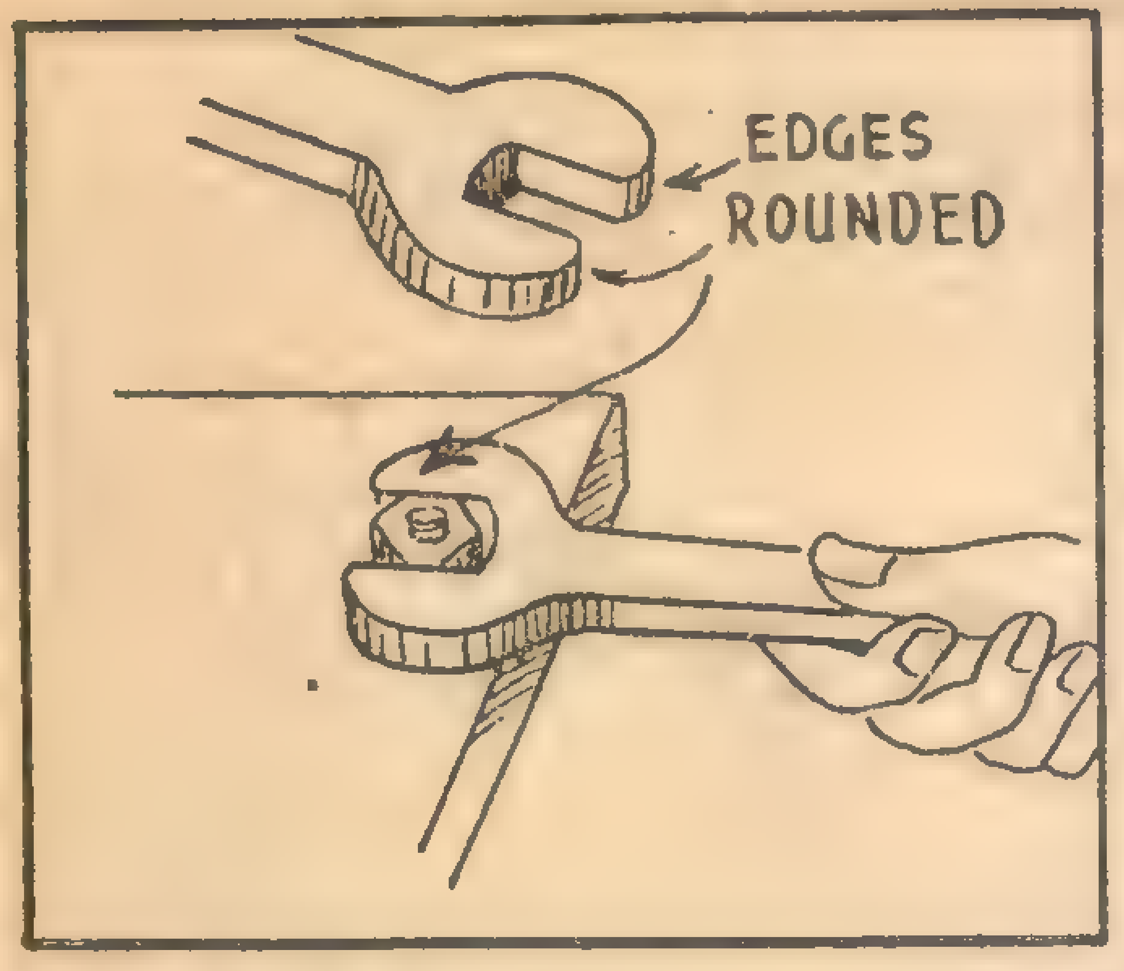
At normal operating speeds, the blades are edge on to the direction of rotation and to the wind, being held in place by a suitable spring.

As the speed increases, centrifugal force causes the blades to be displaced from the edge-on position, so that they act as a wind brake and also serve to deflect the air from the propeller. Note that the blades should be directly in front of the propeller for most efficient operation.

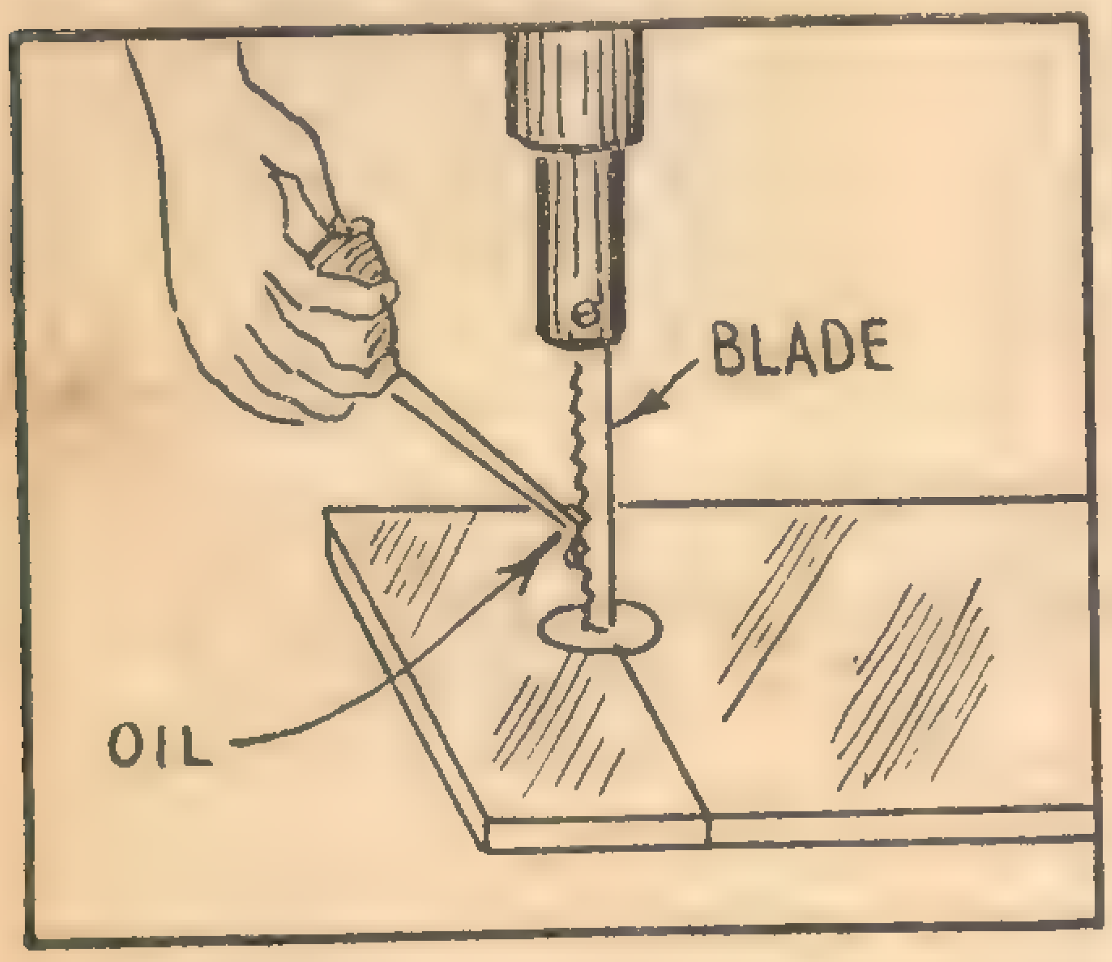
WORKSHOP

The Easy Way

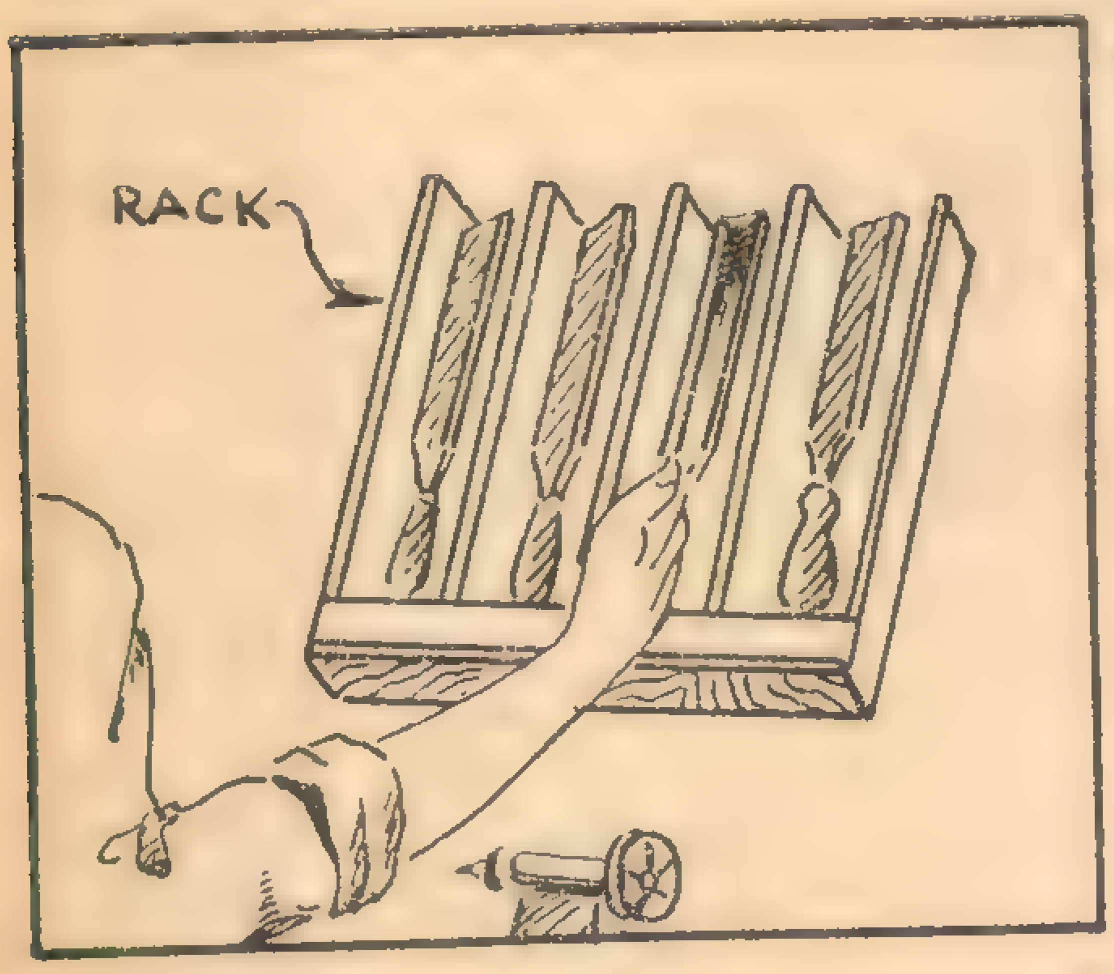
By W. G. NICHOLLS



A SET of wrenches can be improved and work speeded up by rounding the ends, as indicated. This makes it easy to slip the wrench on to the nut.



WHEN sawing resinous wood on your scroll saw, much trouble can be saved by putting a few drops of oil on the blade before starting on the job. This prevents the resin from sticking to the blade and causing the latter to stick in the guides.



A RACK for wood-turning tools, as illustrated, is easily made and can be attached to the wall handy to the lathe. If the tools are kept always in the same compartment, you will soon be able to select the correct tool without even glancing at the rack.

JOE'S COLUMN

WHENEVER you are buyin' furniture, it is always good to know what to look for. Although it is a credit to most manufacturers that they do put honest work into their goods, there is always that minority of firms turnin' out furniture that outwardly looks good quality, but will not stand the searchin' eye of a buyer who knows what points to look for.

Take the case of tables. You may be buyin' a table for a special part of the house. Naturally, you choose a design and wood that suits the room in which it will be used and a shape suitable for the job it has to do. But your selection shouldn't end there.

The table may be a solid wood or a veneer. Both types have advantages. Very often the fact that a table is made of solid wood is offered as proof of it bein' a fine table. But if you are buyin' a table with a top of solid wood, look underneath and make sure that the top is held to the frame by metal clamps. In a top of solid wood, no matter how well it has been dried by the manufacturer, there is always a tendency for it to expand and shrink durin' the changes of temperature, and these metal clamps enable the top to do this without splittin'.

Many buyers are scared by the word veneer. They have the misconception it is merely a thin covering of attractive wood over a multitude of sins, and that veneered furniture is of inferior quality. That is the wrong idea altogether and some of the finest tables are made of veneer.

The best wood in the world will not make a durable table unless it has been joined up well. The legs should be made of one solid, straight-grained piece. Dowels and glue should be used on all joints. Examine the joints and see that all pieces have been cut so that well-fittin' joints have been made everywhere.

The right finish not only seals the wood and protects it, but gives the table much of its value. It should be soft and satiny to the eye and to the touch, but never overshiny and glassy-lookin'. Move your head around and look at the reflection of a light all over the table-top and you will be able to fish out any dead spots, if any.

Have you ever actually heard a large table-top that has been made in two sections split apart suddenly? I have and it sounds like an unexpected revolver shot right beside your ear. Once an office staff I know received a tremendous shock when one went off and the source of the noise was a mystery to everybody until later in the day a clerk noticed that his table had a crack about three-eighths of an inch wide right down the centre. The firm had bought it about a month previously with three others and there was much speculation and jokin' among the staff as to whose would go off next. Eventually they all did, and all within a few days of one another, much to everyone's hilarity.

INTERFERENCE IN CAR RADIOS

(Continued from Page 53)

Sometimes the friction of the tyres on the road will cause crackling due to the static electricity produced. This is usually worst on concrete roads, and all that can be done is as stated previously, for wheel noise. It cannot be stopped completely, however, as the cause in this case is quite apart from the car itself.

The brake shoes may also cause noises; such noises often indicate incorrect adjustment, and the cure is obvious. Bonding of control rods and other metal pieces to the chassis is often necessary.

In older cars it is usually necessary to bind all control cables which enter the engine compartment, and earth these to some point on the chassis. Most of these older cars have wood and metal bodies, and frequently sections of the metal work become partially insulated from the remaining body and cause crackling, particularly on rough roads. Connecting these parts securely with copper braid will remedy this trouble.

SPIDER SILK

EXTRACTION of silky webs from spiders for use in the manufacture of camera view finders, surveying instruments and precision lenses for range-finders and target sights is the work of Mrs. Nan Songer, who operates a unique defence industry in Southern California.

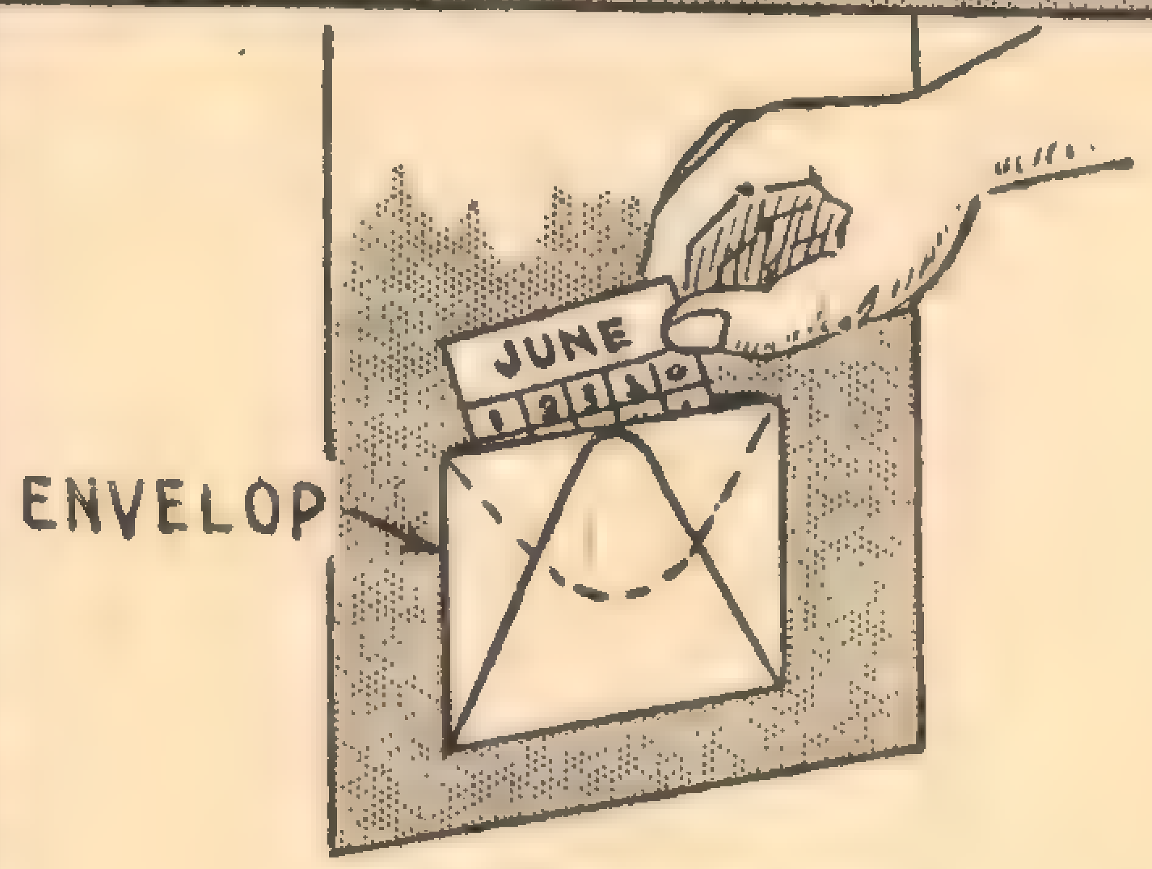
Occupying a single room on her farm in the beautiful Yucaipa Valley near Redlands, Mrs. Songer finds that the defence programme can use all the infinitesimal filaments she can wheedle from a selected stock of busy arachnids. It takes steady hands and sharp eyes to extract the spider silk which the United States Bureau of Standards decrees shall have no greater diameter than .0001 of an inch.

When used in bomb and torpedo sights two strands are crossed at right angles on the face of the lens, where they assist in aiming the instruments.

To extract the silk, which Mrs. Songer says entails no discomfort to the spider, she first arranges so the tiny creature can't scamper away and break the strand. Then with a tiny instrument she gently stimulates the spinneret (a cocoon-shaped organ with which the arachnid spins its web). This starts the thread, the end of which Mrs. Songer skilfully fastens to a shellacked, U-shaped metal reel. Slowly she turns the frame, exercising extreme care that the strands do not overlap, and the shellac holds them in place.

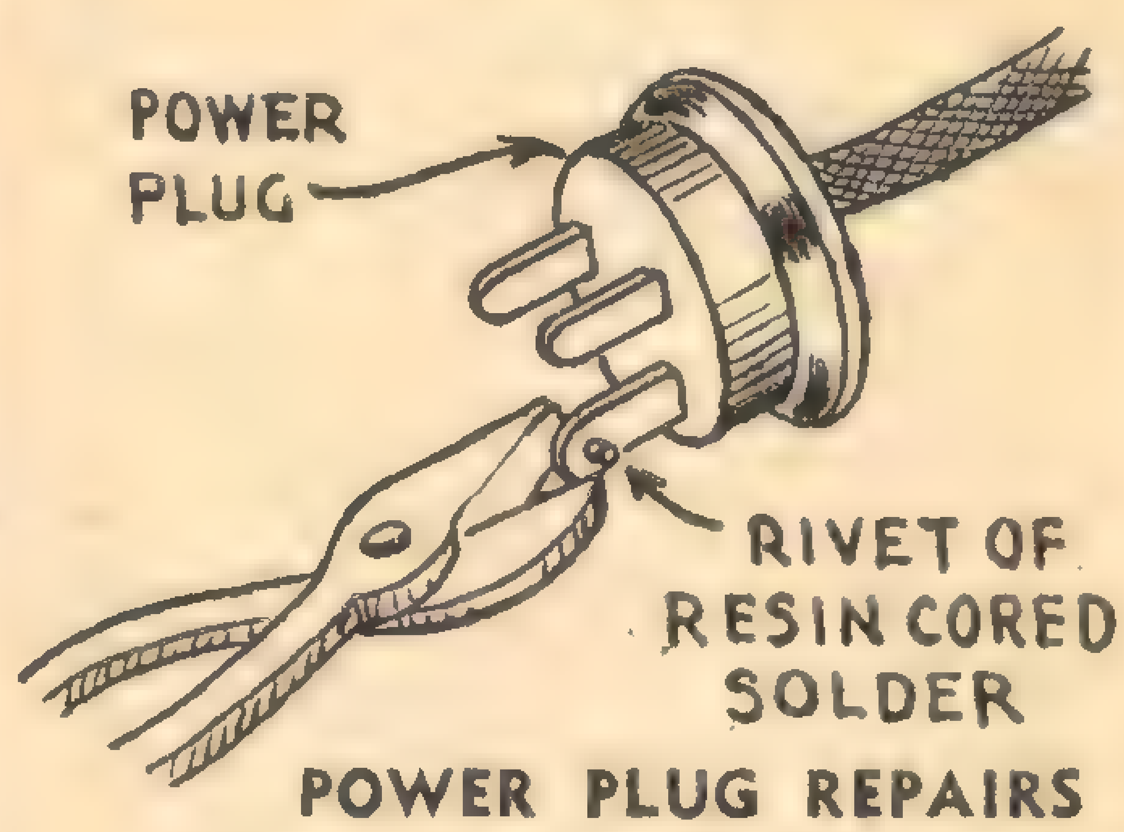
If the tension is constant and gentle, the spider will spin until its silk thread may reach, in about an hour, a length of 100 feet or more before the supply is exhausted. Mrs. Songer only works about two hours a day and markets her silk at 10 cents a foot.

USEFUL HINTS FOR THE HOME HANDYMAN



CALENDAR HINT

An envelope with the flap folded back and stuck on the back of your wall calendar, as shown in the accompanying sketch, will provide a handy place to keep the calendar sheets for future reference.

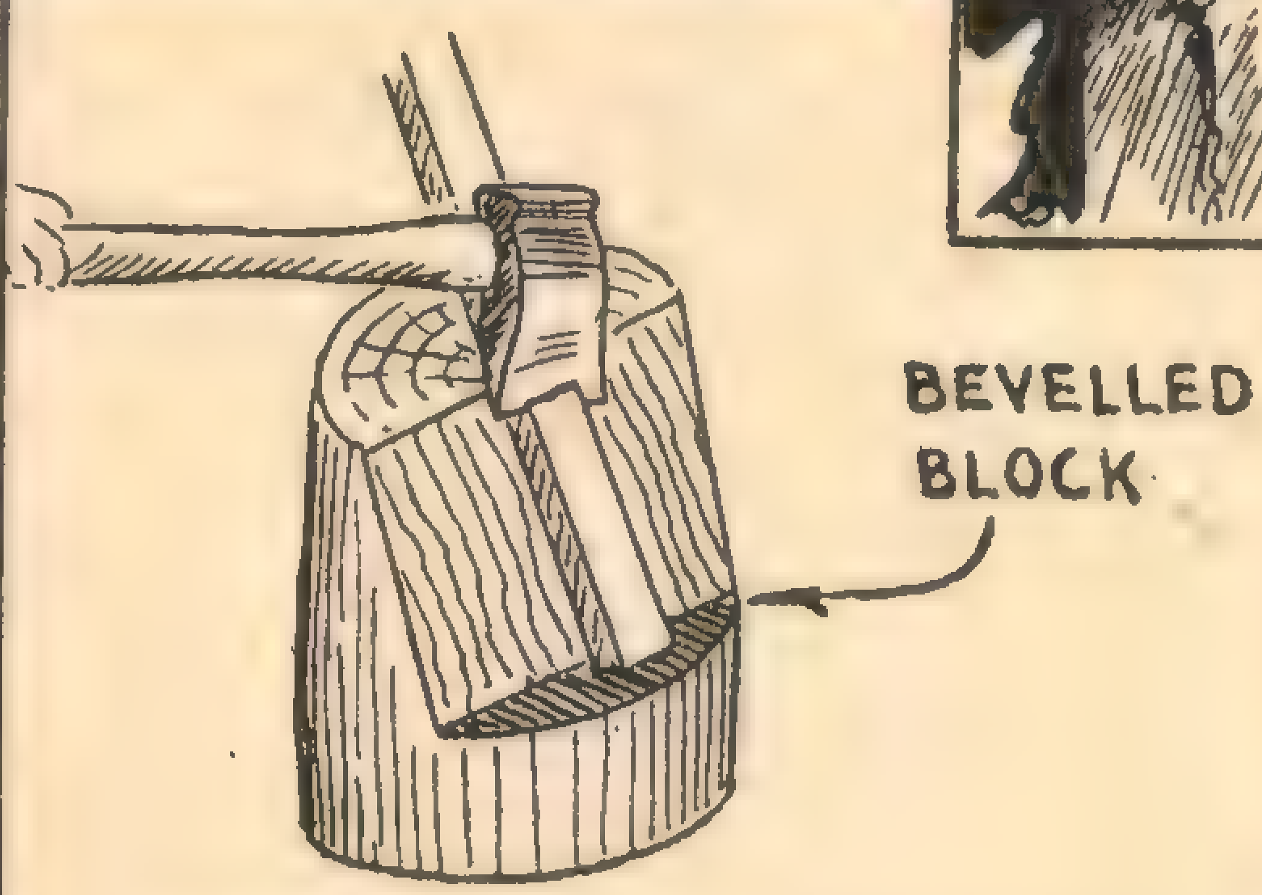


POWER PLUG REPAIRS

If one or more of the blades on your power plug is not making contact and you cannot repair the socket, drill a small hole through the offending blade, pass a short length of resin-cored solder through the hole and burr back each end with a pair of pliers to form a rivet.

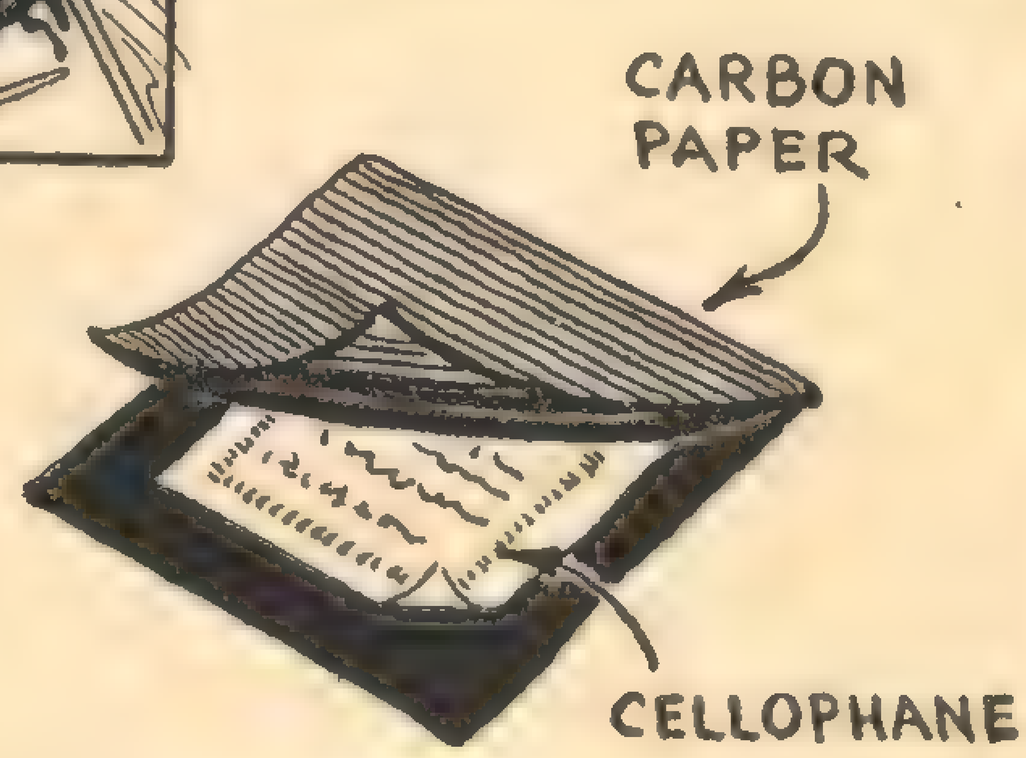
TIME SAVER

Time and temper will both be saved when assembling electrical fittings on a step-ladder by making a circular piece of resin-cored solder and placing it around screws and other small parts to prevent them rolling on to the floor — as illustrated at left.



BEVELLED CHOPPING BLOCK

By cutting a bevel on your chopping block as shown in sketch above, kindling wood may be cut without danger of injury from flying pieces. The projection at the bottom of the bevel holds the wood firmly while cutting.



LANTERN SLIDES

Lantern slides for your church bazaar or concert are easily made by placing a piece of cellophane between a folded sheet of carbon paper, keeping the pigment side in. Place in typewriter and type message, remove cellophane and mount between glass for protection.

BROADCAST BAND DX

by Roy Hallett

Again, this month, we have received a fine batch of reports both from old acquaintances and from a number of new "recruits." Listed among the stations received are some excellent DX catches. We are thankful for the ready co-operation of readers in the preparation of these notes.

FOR the first time in these columns, we report reception in our country of some South American medium-wave stations. Mr Dudley Spencer, and Ern Suffolk were the first to report these, which are heard around 12.45 am at varying signal strengths.

The best of these is LS4, 670kc., heard with speech in Spanish at 12.40 am, closes with announcement in English at 1 am; LS4 is in Buenos Aires, Argentina. It appears to be slightly off frequency, and comes in on 674kc. rather than on 670kc.

PRE7, on 1410kc., in Sao Paulo, Brazil, is also heard, closing with an English announcement at 1.0 am. Mr. Suffolk is hearing a station under 4QG, Brisbane, on 800kc. and closing at 11.30 pm Standard time; he has not yet identified this one, but suggests it may be PRA2, Rio de Janeiro, Brazil.

Mr. Spencer has been fortunate in logging TGW, Guatemala City, Guatemala, Central America, on 1520kc. This station was logged around 8 pm and is undoubtedly a real DX catch. It is very seldom DX'ers in this country report reception of South and Central American stations.

INDIAN ON 630KC.

The writer has been hearing what I believe to be an Indian on 630kc. in the early morning. It has been heard with the rebroadcast of the BBC News, at 3 am, after which an Indian type programme is broadcast. Mr Condon and Mr. Cushen were first reporters to report. The writer logged it at quite good signal strength; as yet the location is unknown. Last month, we reported XGAP's change to 650kc. This change was apparently not to their satisfaction, as they have now moved back to their former channel, 640kc.

Mr. Tinning tells us about a station he is hearing around 5 am on 868kc. with both European and Asiatic type programmes. He at first thought it was Teheran, Iraq, but now suggests it may be Djedida, Tunis. What do you think?

Mr. Berndt, Qld., is hearing several Orientals, which he has been unable to identify so far. We shall quote these, as readers may care to try for them. There appears to be quite a jumble on 900 and 1000kc. XOJB, Shanghai, is heard well on the former channel till about 12.15 am. Mr. Berndt is hearing what sounds to him like a Japanese station, on same channel as XOJB, causing plenty of QRM. Saigon is heard well in WA on 1000kc. and our friend is hearing what he believes to be another Japanese station, causing plenty of interference to Saigon. At 10 pm one evening he heard a Japanese-speaking station coming in through 2NR's signal, on 700kc. Another Japanese is heard on 750kc., which may be JFAK, Formosa, and a Chinese-speaking station, 1050kc. Another reporter is hearing a strange Oriental on 670kc. at night, and the writer has noticed yet another, sounding like an Oriental, coming through under 6WA's signal on 560kc. at 12.10 am.

DAYLIGHT SAVING TIME

WHEN daylight saving was introduced last season, it proved to be quite to the DX'ers' advantage. It means that Australian stations close an hour earlier than previously, thus leaving open channels on which Asiatic and American stations may be logged. Of course, it also means that the Australians open an hour earlier, so that we have less time to listen to the Europeans. Daylight saving begins on September 27, and all times in this page are, unless otherwise stated, in Eastern Summer Time.

VERIFICATIONS

Quite a number of interesting verifications have been received by various DX'ers recently. Mr. Obey has his verie to hand from KGA, Spokane, Wash., USA. The writer and Mr. Skelton (Vic.) have replies from KFBK, Sacramento, USA. The writer was fortunate to receive some interesting newspaper clippings from this station, and pictures of KFBK-NBC artists. Many of our readers, too, are receiving their QSL's from many Australian and New Zealand stations.

Readers are reminded to watch for the midnight Americans, from around 10 pm to midnight. Watch for KSL 1160kc., KNX 1070kc., KPO 680kc., particularly around 11 pm. Europeans may be heard soon, too, just prior to sunrise. Watch particularly for Sofia, 850kc., and Genoa, 1357kc.

Mr. Berndt (Qld.) has two new Americans to add to his log. He is hearing these round 7 pm. WKWW, Brooklyn, USA, 1520kc., and a Mexican, XEDG, with studios in San Diego, Calif., USA, on 1550kc. Watch for these. XEGB, formerly on 1010kc., has also been logged by Mr. Cushen, NZ.

INTERESTING DX TIP

AN interesting DX tip comes from Mr. Hooper. He reminds us that all Australian radio stations hook-up for the Canberra Statement nightly, at 7 o'clock, and suggests that during the period between 7 and about 7.08, listeners turn round the dial in search of stations with a different programme, as such a station would be located outside Australia. If the latter is at all a strong signal, it may be copied through any Australian that may be on the same channel. For example, 4YZ, Invercargill, NZ, may be copied through 2HR, 7QT, and 4AT, if it was at all strong. KFI, Los Angeles, USA, may, if it happened to be coming in, be read through 5CK, &c.

Some radio dials are not marked in kilocycles, and this makes finding very weak overseas stations rather difficult. Don't let this stop you from doing some DX. With a little practice, finding weak and new stations on poorly calibrated dials becomes fairly simple. Here is one system often used: You know an overseas station is operating on a certain frequency, say, for example, Breslau, on 950kc. You know, too, that 2UE, Sydney, is on this channel. Simply note 2UE's position on your dial, and, at the suitable time to hear Breslau, tune to that spot, tuning carefully a little to either side.

LISTEN FOR THESE

THIS month, instead of a summary of a few stations in several countries audible at present, we present a list of European stations likely to be heard this season. This list is by no means complete, so watch out for many others. We also deal with a few miscellaneous stations audible, and next month, we shall probably cover the Americans.

Few Europeans use call-signs. The best time to hear these is from around 3.30 am to about 6.30 am.

Radio Lyons, France, 1397kc.
Genoa, Italy, 1357kc.
Radio Mediteranee, France, 1276kc. power, 27kW.
Frankfurt, Germany, 1195kc., 25kW.
Nice, France, 1185kc., 60kW.
London National, 1149kc., 20kW. (often uses foreign languages, as well as English programmes).
Konigsburg, Germany, 1031kc., 100kW.
Bratislava, Czechoslovakia, 1004kc., 13.5kW.
Poste Parisien, France, 959kc., 60kW.
Breslau, Germany, 950kc., 100kW. (about the best of these now).
Brno, Czechoslovakia, 922kc., 32kW.
Radio Toulouse, France, 913kc., 60kW.
Radio Sofia, Bulgaria, 850kc., 100kW.
Toulouse, France, 776kc., 120kW.
Prague, Czechoslovakia, 638kc., 120kW.
Rome No. 2, Italy, 1222kc.
Rome No. 1, 713kc.
Florence, Italy, 610kc.
Paris, France, 695kc.
Hilversum, Holland, 724kc.
Kuldiga, Latvia, 1104kc.
Vaasa, Finland, 1420kc.
Irish Regional, 977kc.
Budapest, Hungary, 546kc.

MISCELLANEOUS.

Try for these around 6 am.
Cairo, Egypt, 620kc., 20kW.
Algers, Algeria, 941kc., 12kW. (around 6 am fair).
ZTD, Durban, S. Africa, 749kc.
ZTX, Pietermaritzburg, Sth. Africa, 697kc.

Try for these Americans around 11.30 pm.
KPO, San Francisco, 680kc. (best midnight).
KIRO, Seattle, 710kc.
KOA, Denver, 850kc.
KNX, Los Angeles, 1070kc.
KSL, Salt Lake City, 1160kc.
WOAI, San Antonio, 1200kc.
KFBK, Sacramento, 1530kc. (opens 11.30 pm).
WCKY, Cincinatti (opens about 8 pm).
KXEL, Waterloo, Iowa, 1540kc. (opens well 9.30 pm).
XEBG, Tijuana, Mexico, 1540kc. (studios, San Diego, Calif., USA; formerly of 1010kc. Closes 8.0 pm).
XEAW, Reynosa, Mexico, 1570kc. (studios, Dallas, USA; fair 7 pm).
KGU, Honolulu, Hawaii, 750kc. (good at 3 am).
KGMB, Honolulu, 590kc. (good at 3 am).

The lists above are by no means complete; we intended to deal more fully with Americans next month, as they should be heard at better signal strength then.

ALL DX reports should be addressed to Mr. Roy Hallett, 36 Baker-street, Enfield, NSW. Reports for the November issue should be posted to reach Mr. Hallett not later than Saturday, October 3, 1942.

READERS REPORTS

THE writer was very pleased this month to receive another batch of interesting reports from readers. This month we thank the following for their reports: W. R. Woodley, Victoria Park, WA; G. Head, Bunyip, Vic.; D. Berndt, Malaney, Qld.; A. Condon, Laura, SA; L. H. Venables, Laura, SA; E. Suffolk, Summertown, SA; D. Spencer, Forest Range, SA; L. Gliddon, Upwey, Vic.; W. Skelton, Queenscliff, Vic.; R. K. Clack, Forces; A. James, Leeton, NSW; K. B. Gaden, Quilpie, Qld.; R. Esterhuizon, S. Aust.

WHEN TO LISTEN FOR STATIONS

FOLLOWING a suggestion from Mr. Head, we present a summary of times and seasons at which various countries are heard best in Australia on the broadcast band.

ASIA: Heard from around 11.30 pm (after locals close, leaving clear channels), till around 2 am, some stations being heard for several hours after this. Stations are audible practically any time of the year, usually best in winter.

EUROPE: Heard best in summer months, from a few hours prior to sunrise, sometimes till a few hours after sunrise (from around 3.30 to 6.30 am).

AFRICA: Usually heard at same time as Europeans. Some South Africans are also heard during our winter months around 5 am.

NORTH AMERICA: Heard around 11 pm and midnight during summer and just after sunset (around 6 pm) in winter. Stations may also be heard fairly well at various times during the evening and night during any season, but are usually jammed at these times by Australians on the same channel.

SOUTH AND CENTRAL AMERICA: Very seldom are stations heard in these areas, but, at present, some may be heard around midnight.

OCEANIA: From sunset to sunrise, any season. Stations in New Zealand, Hawaii, Fiji, Noumea, &c., are audible at various hours when on the air. (NZ till about 9.30 pm and from 4 am. Fiji around 7 pm. Hawaii, from 1.45 to 3 am.)

Note: Times stated above only are Eastern Standard Time.

ANSWERS TO CORRESPONDENTS

UNDER THE PERSONAL SUPERVISION OF THE TECHNICAL EDITOR

E.L. (Footscray, Vic.) has a small commercial receiver which has the habit of fading ut and distorting badly after it has been n for half an hour. Switching it on and ff a few times effects a temporary improvement.

A.: The trouble may be due to a variety of auses, but we suspect that either the second etector or output valve may be drawing grid urrent when it becomes properly heated. The rouble would probably not show up in a valve ester, and would only be revealed by replacing the suspected valves one by one. It ould be an expensive business to buy new alves just for trial, and we suggest that ou would be well advised to let the local erviceman have a look over the set.

A.R. (Tewantin, Qld.) sends in a three-alve regenerative receiver circuit for omment.

A.: We have read with interest your previous etters. You certainly appear to have had lot of success with this particular type of eceiver. When the opportunity affords, we ill try out your scheme for reaction and, successful, will publish it with due acknowedgements. We are still not happy about he idea of using an output valve as the etector. A valve such as the 1K5-G is uch less likely to give trouble with microhony.

R.M. (Bexley) has built up a two-valve eceiver, but finds it rather inselective.

A.: The selectivity of small receivers of this ature is limited at any time, due to the se of but a single tuned circuit. However, should be better than you state. Selecivity is always best with the reaction conenser adjusted so that the set is just below he point of oscillation. You may be able o improve matters by decreasing the number f turns on the aerial winding of the coil or y shortening the aerial. Often the desired esults can be obtained by connecting a 005 mfd. condenser in series with the aerial ead-in. The idea is to operate the receiver ith the condenser as far out of mesh as ossible, consistent with sufficient signal trength. You can use different settings of he condenser for different stations.

Unsigned (Epping) asks a number of quesions about a regenerative receiver.

A.: Broadcast coil wound on ¾in. diameter ormers are not the best for regenerative reeivers. The formers should preferably have diameter of at least 1¼ inches. The reaction ould be wound over the earthed end of the econdary, the primary winding being eliminted and the aerial being taken to a tapping few turns up from the earthed end of the econdary. For the short-wave band, wind n about 11.5 turns of 22 B&S enamel spaced o occupy ¾in. The aerial coil may be interound from the earthed end, being 4 turns of B&S enamel. For the reaction, wind on bout 8 turns of 34 B&S close to the grid end f the secondary. It is possible to arrange ands switching in a small regenerative reeiver, but it is not always easy to keep the eads to the coils short, with the result that the eceiver is often inefficient in its operation. urthermore, there is often trouble due to bsorption losses from the coils not in use. he receiver circuit is unsatisfactory in various ays. There should be no bias on the gridak detector. There should be a grid resistor f about 1.0 meg. between the grid of the mplifier valve and earth. The bias resistor or the latter stage would be about 3000 ohms. here would scarcely be any need for an udio gain control; if this is included, it hould be in the grid circuit of the audio mplifier valve. The output voltage from the ower supply would be far too high as it ands. You would need to connect a heavy uty resistor between the filament of the ectifier and the junction of the first filter ondenser and choke, the value being adjusted give an output voltage of about 250 volts. es, the 4 mfd. condensers should be OK for he purpose.

J.A.B. (South Johnstone) is puzzled about ertain paragraphs in a physics book which e has been studying.

A.: We are not familiar with the book you ention, but have been holding over your tter in the hope of being able to go into e matter for you. However, we are so shortanded as a result of call-ups and sickness at we simply cannot spare the time to do . Sorry, but that is all there is to it.

E.A. (Ravenshoe) writes in suggesting that we should describe a short-wave converter for battery operation.

A.: Thanks for the letter, E.A. By this time you will, no doubt, have received the September issue, which should be well up to your liking as a country reader.

J.C. (Kingaroy) has had a lot of fun building up different battery receivers and suggests that it is about time we described another big battery set.

A.: Thanks, J.C., for the suggestions and for the encouraging remarks in regard to "R. & H." We have in mind to describe a large battery receiver after we have cleared off a number of items for which there is a pressing demand. Owing to the limited space available, we cannot cover too much ground in any one issue. We are pleased to note that you liked the 1942 Pentagrid Four and the Pentagrid 46. Tone control for the latter receiver certainly presents a problem, and we have not had opportunity to go into the matter. However, the introduction of a heavy bypass between the plate of the upper 1K7-G and earth might work out to your satisfaction. The "Economy Seven" could certainly be built up around the 2.0 volt valves, but the word "economy" would probably have to be deleted from the title. It would certainly be a very sensitive receiver, but the battery drain would be much higher than with the 1.4 volt valves. If the I-F gain was too high, the receiver could be stabilised by reducing the screen voltage of the I-F amplifiers or by increasing the initial negative bias.

J.B.M. (Chernside, Qld.) requests an easy method of connecting a pair of earphones to his 4/5 valve dual-wave receiver.

A.: You could connect one side of the earphones to the chassis and the other side through a .01 mfd. 600v. condenser to the grid of the 6F6-G output valve. If the set has a low hum level you could make the connection instead through the condenser to the plate pin of the 6F6-G. In this case you would have to be careful to avoid turning up the volume with the earphones in circuit, as they might easily be damaged. The use of a phone jack would facilitate the connection and disconnection of the phones from the circuit.

E.C.J. (RAAF) notifies of a change of address and makes some general comments in regard to "R. & H."

A.: Thanks, E.C.J., for the kind remarks in regard to "R. & H." Best of luck! Your change of address has duly been noted.

F.R.G. (Geelong) makes some comments about d-c receivers and some suggestions for future articles.

A.: We are pleased to note that you appreciated the recent article on d-c receivers. Certainly they have a lot of "snags," but they do have the advantage of operating from power mains and are not dependent on batteries; this is a real advantage as things are at present. Thanks for the suggestion in regard to an article on output transformers. We published a general article on this subject in the March, 1942, issue, which might help you. You may be able to get further help from a book such as the Radiotron Designer's Handbook. We will keep your suggestion in mind, and may present a more specialised article when the opportunity occurs.

Cpl. H. (Home Forces) makes a suggestion in regard to earths for locations where the ground is very dry.

A.: Your idea of using a water pipe as an earth and keeping it filled up with water is quite a good one, but is not by any means new. Packing around it with clay might also help in some cases, but it would depend a lot on the nature of the surrounding earth whether the clay would help in retaining the moisture. In very dry locations a very good plan is to bury an earth wire or a network of wires in the ground underneath the aerial. This acts as a counterpoise. When attaching the grid cap to a valve, the danger of breakage is due to the rapid expansion of the wire lead through the glass, as well as the heating of the surface of the glass. The use of the washer as suggested might help, but would not entirely remove the danger of cracking.

S.C. (Mt. Gambier) wants to know about scratch filters.

A.: A scratch filter is a device used in connection with a gramophone pickup to minimise the random noise due to the texture of the recording medium. They vary, according to price and requirements, from very simple resistance-capacity arrangements to elaborate tuned filter circuits. The manner of connection varies, and we suggest that you ask for instructions when you buy a particular unit. It is quite normal for the pickup to make an audible noise when the amplifier is turned down. This noise is not conducive to enjoyable reproduction, and it is highly desirable for the pickup to be totally enclosed during playing.

H.I. (Narrikup, WA) suggests that we should build up and describe a battery operated communication type receiver in the near future.

A.: Thanks, H.I., for your suggestion. Yes, we have no doubt that such a set would command quite a lot of interest. But there are so many requests to meet and so few opportunities to meet them under the present conditions. However, we will keep the suggestion in mind.

B.L. (Brisbane), spokesman for a number of young chaps 16 years of age, reports having built up the amplifier PA-3. They use it with microphone and pickup, and apparently have quite a lot of fun with it.

A.: Glad to read of your success with the amplifier PA-3. Yours is one of many enthusiastic letters received about this particular circuit. If you cannot get any more 6V6-G valves, you could change over to 6F6-G valves using a 250 ohm bias resistor and a 2500 ohm screen load as for the "T.R.F. Quality Six" receiver.

K.M. (Kingswood) is in trouble with the A-C audio oscillator described some months ago.

A.: We note your suggestion in regard to publishing a resistor color code chart, and will keep it in mind. From your letter, it appears that you have things well and truly mixed up in regard to the power supply of the oscillator. With your transformer you would have to connect the two 350 volt lugs to the respective plates of the rectifier and the centre tap to earth. The 80 serves as the rectifier and is not a detector. We would point out that the heater winding is apparently a 4.0 volt winding, and would require the use of a 4.0 volt valve, unless you used a 2.5 volt valve with a dropping resistor. We suggest that you would be well advised to enlist outside help if at all possible.

C.G.G. (Cremorne) has a receiver which will not operate for some time after being switched on. During the period in which it is inoperative, the magic eye is closed right up.

A.: The trouble could be caused by many things, and it is impossible to list them all. However, it is possible that one of the valves connected to the A.V.C. network or the magic eye itself has a slight air leak which causes grid current to flow for a period after switching on. On the other hand, there may be some obscure oscillation trouble. Try removing the magic eye from its socket and see whether the receiver then operates as it should. Shorting out the A.V.C. line to earth would give a clue as to whether a high negative voltage was building up. If you cannot trace the trouble easily, it would be a good plan to call in reliable servicemen who could measure all the voltages while the receiver was inoperative. Thanks for the encouraging remarks.

"Sydnee Dig." sends in a subscription to "R. & H." and goes on to tell of his interest in radio and short-wave listening.

A.: Your subscription has duly been recorded and you should get all future issues direct. We trust that you will not miss out on issues, as you have been doing. We read with interest your letter, and hope that you will one day find yourself in a better spot for S/W listening. Our activities are pretty limited these days one way and another, but we will certainly do our best to keep the standard of "R. & H." as high as possible.

SHORT-WAVE REPORTS

R. G. Gillett (Dudley Park, SA): Many thanks for your several letters for the very useful information in them. We had heard all the stations but one, but we are grateful nevertheless. You will notice that you are in the news this month.

L. Walter (Applecross, WA): You are right when you remark on the strength of the Americans. They certainly pound in here. Thanks for the information as regards ZNR. Best wishes.

J. N. Paris (Prospect, SA): Your report is excellent, thank you. We are always glad to hear from you. Pleased to see that reception is good out your neck of the woods.

Dr. K. B. Gaden (Quilpie, Q.): Very glad to receive your letter, which we will answer in the near future. You were quite correct in guessing the source of my information. We received the information in the wire from our friend. Regards.

G. Rhodes (Canberra, ACT): The reception in Canberra seems to be very similar to that obtaining here. Thanks for the log. The 16-metre band is now on the improve.

R. Hallett (Enfield, NSW): Yes, the European stations have improved very much in the past few weeks. Glad to see that you are still getting among the stations. All the best.

Mr. A. T. Johnson (Maylands, WA): You will see that we deal with your query in the body of our notes. As regards the B/C station, we will pass your question on to Mr. Hallett to answer.

H. Perkins (Malanda, Q.): You have, we hope, received our letter by this clearing up the matter in question.

E. J. Perrett (Marrickville, NSW): You seem to have your Kc and Megacycles mixed up. In addition, you are receiving KWU on the second spot. See the list for the correct wavelength. Glad the aerial is giving satisfaction.

W. N. Tuxworth (Sarina, Q.): Your report to hand. The Americans are very strong these days. Will be glad to hear from you again.

E. Renfrew (West Wallsend, NSW): Sorry to learn that you missed out on your copy, but you now realise how difficult it is to get extra copies. Send in a log as soon as you can.

G. Swingle (Hawthorne, Q.): The log is very fine, and we will be glad to receive each monthly edition. Dealing with your mysteries in the notes. Best wishes.

R. K. Clack (Home Forces): Pleased to learn that reception is good at your location. By your log you seem to be doing well.

M. Morris (Merewether, NSW): Many thanks for the very interesting letter and for the enclosure. It is very interesting, and you will see our reference to it in the notes. Will return it to you.

E. Jamieson (Home Forces): Very glad to hear from you again. Regret the absence of your logs, but we will expect to hear from you when all this is over. Best wishes.

B. Kellehar (Newport, Vic.): Thanks for the stamped addressed envelope. Will reply immediately. Regards.

S. Jones (Punchbowl, NSW): Your letter to hand. The enclosure is very interesting indeed. Keep up the good work.

A. T. Cushen (Invercargill, NZ): We are sorry that the reference was omitted, but we are sure you will realise how it happened. Your reception seems to be up to standard. Regards.

R. K. Clack (Home Forces): Your letter is very interesting, and we will see whether we can get the enclosure translated for you soon. You are very fortunate in getting such a novel reply to your report. You will notice that we have dealt with this in our columns.

W. Harvey (Dubbo, NSW): The addresses you quote are quite in order. We hope that you are successful in getting your veri's. The other stations are pedal-operated stations in the interior.

L. R. Suleau (Roseville, NSW): Glad to hear that you are to resume reporting. Thanks for the kind remarks. We have no doubt that you will soon regain touch. Best wishes.

H. Perkins (Malanda, Q.): Your letter, as usual, very interesting. Glad to read of your veri. Conditions seem to be holding up in your part of the country. Hope that you received your letter. Regards.

E. H. Suffolk (Summertown, SA): Thanks very much for your letter, and we are anxiously awaiting your further letter. Thanks for the trouble you are going to. The balance of the letter will be dealt with in the near future.

A. T. Cushen (Invercargill, NZ): Your letter very welcome, and thanks very much for the photo. We will be very interested in the issue of DX-TRA which you propose sending to us. Any literature you can send will be very gratefully received. Thanks again.

A. E. Moore (New Farm, Q.): The conditions you are experiencing are those obtaining here. Your log is very comprehensive. Congratulations concerning the veri you received from Peru. Write again.

H. Suffolk (Summertown, SA): Thanks very much for your letters, but we are afraid that you omitted the drawing. We hope to get this soon. Best wishes.

A. S. Condon (Laura, SA): As usual, your log is full of interest. The information has been made use of, as you will notice. Glad you enjoyed the holiday. Hoping to hear from you again.

Broadcast DX

E. H. Suffolk (Summertown, SA): Many thanks for those reports of yours; so glad you have logged the South Americans. Reports out to nine Americans in eight nights is good going. All OK re the band-spreader.

D. Spencer (Forest Range, SA): Congrats re logging of TGW and South Americans. Am anxiously awaiting the result of the 1540kc. reports. Thanks for the information re XEBG.

E. J. Perrett (Marrickville, NSW): Many thanks for those letters of yours. KWU on 19 and 53 metres is still good here. That aerial of yours certainly appears to be a winner; I am looking forward to trying it out myself.

G. Obey (Bronte, NSW): Thanks for your letter. I guess you are looking forward to the summer season with the Americans. We should hear plenty of them, especially with daylight saving again this season. KPO is the best here at 11 pm at present.

L. Gliddon (Upway, Vic.): Always pleased to receive those notes from you. Glad you have got those veri's back from the various stations reported. All the best with that radio course you have decided to take.

A. Condon (Laura, SA): Those well set out reports of yours are always welcome. You and Wally must have had some fun together at those all-night sittings. You certainly manage to pull in the Europeans over there.

R. K. Clack (Somewhere in Australia): Many thanks for your letter; glad to know you are interested in Broadcast Band DX. I hope the letter sent you by mail was of interest. That radio set of yours seems to be able to pull in some interesting DX stations.

G. Head (Bunyip, Vic.): Thanks so much for that excellent report of yours; conditions certainly appear to be OK for DX at your location at present. The details you gave me about the various stations you have logged was most interesting.

K. B. Gaden (Quilpie, Qld.): Always glad to receive those reports from you. XEAW is not so "hot" at my location. Glad you got your veri from KFBK, and hope the card from 6KY soon makes its appearance at Quilpie.

A. James (Leeton, NSW): Many thanks indeed for your letter. So glad you are interested in DX and like this section of "R. & H." Thanks also for those details of KXEL's programmes. You have quite a good log of DX stations to your credit already. Keep up the good work.

D. Berndt (Melaney, Qld.): Thanks a lot for those several first-class reports of yours. Like most of our other reporters, you always have plenty of interesting DX to chat about. Those Americans above 1500kc. are certainly providing us with some interesting DX. You seem to be able to log plenty of them, Doug.

R. Woodley (Victoria Park, WA): Many thanks for the details of Braslau programme you heard. Nearest Nazi station to 341 metres is, I think, Hamburg, 331m., or on other side Strasburg, 349.2m. Yes, this German has been heard over here. I'd be pleased to hear from you any time you hear anything unusual. Was interested in the details of your DX equipment.

L. H. Venables (Laura, SA): Thanks so much for your letter. Yes, I have had some splendid reports from Mr. Condon. You have quite a good log of stations already to your credit. Hope you receive some veri's soon.

W. Skelton (Queenscliff, Vic.): Glad to hear from you again. You certainly have a fine batch of veri's for such a short time of listening. Shall tell Mr. Whiting about WJB; thanks for details.

Mrs. R. Esterhuizen (SA): Many thanks for your report. You and your husband certainly "go places" with that radio of yours. Good "fishing."

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